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APRIL 1951

AUREOMYCIN IN ACUTE INFECTIOUS MONONUCLEOSIS — *Maurice Vaisberg*

OCCUPATIONAL INJURY — *William F. Ashe*

GENERAL PRACTICE CLINICS

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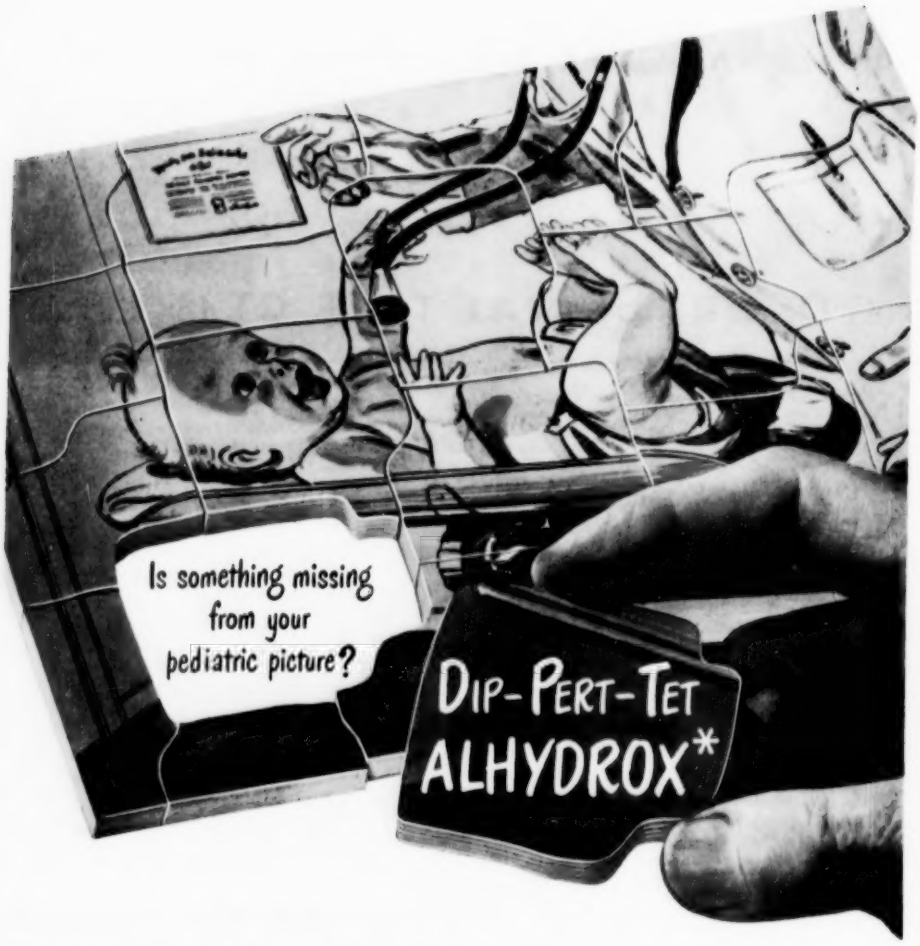

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Aureomycin in Acute Infectious Mononucleosis

MAURICE VAISBERG

Miami Beach, Florida

In a recent publication Gruskin[1] noted spectacular results in the treatment of the severe symptoms of acute infectious mononucleosis with aureomycin. This paper shall present another case report in which aureomycin was similarly effective.

CASE REPORT

H. B., a white female, aged 31, had complained for a period of two weeks of increasing lassitude and weakness to the point of exhaustion. Along with this there was profuse sweating, rapid pulse, irritability, low grade fever, pains in legs and back. Physical examination was not significant except for a consistently low blood pressure varying from 80/50 to 90/60. Early Addison's disease was suspected, and the following x-ray and laboratory data were secured:

X-rays of chest, adrenal region, and spine were negative;
B M R was plus 17 per cent;
Agglutination tests were negative except that for B proteus X-19, which was 1:80;
Sedimentation rate (Wintrobe) was 10 with 37 per cent hematocrit;
Blood showed 12.5 Gm. Hb.; 3,690,000 R.B.C.; 8,750 W.B.C., with 76 per cent segmenters, 2 per cent stabs, 16 per cent lymphocytes, 2 per cent eosinophiles and 3 per cent mononuclears;
Blood cholesterol was 242. N.P.N. was 31;
Heterophile titer was 1:112.

Since it was not certain at the time whether she had acute infectious mononucleosis or the chronic[2] form, she was treated for three days with

injections of adrenal cortex hormone without any appreciable relief. Then 250 mg. of chloromycetin was given every four hours for four days along with the adrenal cortex. It was during this time that the acute nature of the disease became manifest. The right satellite tonsillar lymph node became swollen and tender; the tongue was sore with many whitish follicles, especially posteriorly; patches of exudate appeared in both tonsillar fossae and on the posterior pillars, and swallowing was painful due to some irritation of the laryngopharynx. Along with these, there was abdominal distention with generalized tenderness. The spleen at no time was palpable. The rectal temperature was 101 F.

Aureomycin was started and chloromycetin discontinued. The dosage was 1.5 Gm. a day. Adrenal cortex was continued and daily injections of 15 micrograms of vitamin B_{12} were administered for the sore tongue. Within 48 hours there was marked improvement of the tongue, the tonsillar exudate, the swollen tender gland, distension, sweating, weakness—much more so than would be expected in such a case without treatment. Aureomycin in doses of 1.5 Gm. a day was continued for six days and then stopped. The injections of adrenal cortex were supplanted by oral administration (cortalex) of six tablets a day and the B_{12} stopped after five daily injections.

Convalescence was uneventful and in two weeks the patient was well, though slightly weak. Blood pressure rose to 120/80.

The author has found aureomycin to be of great value in herpes zoster, relieving all symptoms within 48 hours.

There is one side effect of aureomycin that the author has not noted elsewhere in the literature. In about 40 per cent of patients (100 cases) treated with aureomycin for one ailment or another, he has found that there develops an irritation of the female genitalia, female anus and male anal region. This is very annoying and is accompanied by a dry redness. It appears either during administration or from 3 to 14 days after cessation of the antibiotic. It appears to be an allergic reaction and is helped by the local application of an antihistaminic ointment.

Summary

It appears that aureomycin is the most valuable single agent to date in the treatment of acute infectious mononucleosis. Adrenal cortex hormone is of worth in alleviating the extreme asthenia caused by this condition. A case report employing these agents is presented. A hitherto unreported side reaction of aureomycin is discussed.

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Occupational Injury*

William F. Ashe, M.D.†

The term "occupational injury" is used advisedly as the title of this paper on the problems of medical diagnosis as applied to diseases and accidents of occupational origin. This term is used because the state and Federal laws pertaining to industrial compensation are beginning to accept "occupational injury" as a blanket term to cover all deviations from normal health which are the direct or indirect result of occupation. Silicosis in miners, furunculosis in machine tool operators, bladder tumors in beta-naphthylamine workers, smashed hands in punch press operators, to mention only a few examples, may all be considered bodily injuries. Fine distinctions between accident, poisoning and disease need not be made.

Much of personal and social malady has its origin in occupational injury, be it psychic or somatic, local trauma or systemic disease. The doctor in industry has an almost unique opportunity to study widely varying groups of men in a relatively normal state, i.e., while they are carrying on their regular work, and to see somewhat more of the genesis of illness, occupational, psychic, and intercurrent, than is seen by most physicians.

The doctor in industry has three distinct tasks: (1) He must determine the employability of men from a medical standpoint, and place them properly. (2) He must determine the nature and severity of occupational hazards, demonstrate the necessity for their control, with the engineer devise ways to eliminate them, and supervise the continual efficient function of all control measures. (3) He must recognize and treat occupational injury. The first two are often more tedious than the third and by far the more important. When well done, they serve not only their own specific purposes but greatly facilitate good management in the third. The joint purpose of all three is the maintenance of a healthy plant population and the promotion of efficient production.

* Some of this material appeared in Pullen's "Medical Diagnosis: Applied Physical Diagnosis," edition 1, and has been reproduced here with the permission of the publishers, the W. B. Saunders Company of Philadelphia.

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The diagnostic procedures of industrial medical practice do not differ in principle from the procedures necessary to establish an etiologic diagnosis in any other branch of medicine. Extreme care in physical examination and careful judgment in the evaluation of the available data lead to correct conclusions with the same high frequency that obtains in other fields of medical practice. Careless work probably produces more errors in this field than in many others.

The Pre-Employment Examination

The pre-employment examination must answer not only the question "Who can work?" but also, "What are the limits of each man's working capacity?" In about 90% of the population of working age the first question cannot be intelligently answered without careful consideration of the second. Perhaps 10% of all persons who are employable from a medical viewpoint are able to do any kind of work. The rest have defects which might exclude them from certain occupations but not from others. A man twenty-five years old, six feet tall, weighing 190 pounds and in excellent health except for a 15% diminution in hearing, might do many things very well but he would endanger his life and that of others if placed at a listening post in a submarine or in an electric hoist in a noisy steel mill. Moderate obesity predisposes the "sand hog" to *caisson disease*, but may be an advantage to men working in refrigerated rooms.

The details of a completely adequate pre-employment physical examination vary with the industry concerned and with the specific jobs in each industry. A history of repeated mild asthma may have little or no significance in a time clerk but may be of serious importance in a rock driller. The specific needs of a number of industries have often given rise to a series of short-cut procedures which, while actually or reputedly advantageous in a specific instance, have often been found wanting when more general medical information is required. Recognition of the inadequacies of incomplete examinations and records has brought about a considerable change in viewpoint and practice in recent years. The need for thoroughness and completeness in the medical study of industrial employees must be further stressed. If it is desirable to make pre-employment physical examinations, it is worth while to do them in such a way as to make sound use of the skill and judgment of a competent physician. The basic essentials of such an examination are not difficult to enumerate. They are a good medical history, a thorough physical examination, and such laboratory data as may be necessary to demonstrate good health and to rule out such defects as are not readily demonstrable by the usual physical diagnostic procedures. Frequently special tests are necessary in relation to certain occupations, to serve as bases against which, at a later date, the adequacy of control procedures may be measured.

Medical History

Previous Occupation. The usefulness of a complete medical history as the background for the interpretation of every applicant's state of health and of subsequent deviations from it cannot be overemphasized. There are certain features of the medical history which may bear an important relation to the employability of a man for a specific occupation and to his safety in carrying on such work. Inquiry into previous occupation is especially important in the case of persons seeking work involving exposure to lead, silica, toxic vapors of a variety of types, and to skin irritants. Several examples will illustrate this point. There are many degrees of *silicosis*, some of which are asymptomatic. If an applicant for work as a stone cutter has been employed previously in a marble quarry, it is of great importance to ascertain whether or not he shows any of the early evidences of this disease. If he does, he must of necessity be excluded from any further exposure to hard-rock dusts. In many industries with exposure to lead, such as paint plants, there are large groups of men who absorb lead in quantities which are well above the normal, yet below the levels necessary to produce evidence of disease. Should such a man be put into a smelting job, where there is even a transient exposure to high concentrations of lead fumes, *acute lead poisoning* might well ensue promptly. If, on the other hand, a man with no previous lead exposure was put into such a job, the transient or intermittent nature of his exposure to lead-bearing fumes would allow him a wider margin of safety. Within fairly well-defined limits *lead poisoning* is directly related to the total quantity of lead absorbed by the body. Lead absorption is measurable because it is reflected by the lead concentrations in the blood and urine, and one may set fairly definite standards of safety. It becomes obvious that with a careful history of previous exposure, a measure of an applicant's present state of lead absorption, and finally a knowledge of the magnitude of exposure in the new job, one can predict what will happen. It is also obvious that if an applicant gives a history of skin disease in a previous occupation, one must make certain before employment that the conditions which produced this lesion are not duplicated in the new job. In most instances information of this type, to be useful, must be comprehensive as well as clear in its significance. Exposure to noxious agents does not always mean absorption. Satisfactory questioning will depend upon specialized knowledge of industrial processes and their attendant hazards. It may happen that the proper decision as to the applicant's fitness for employment will depend upon the accuracy of this portion of the medical history. More commonly the history will determine the desirability for, and the choice of, special tests of the applicant's physical status.

Too often the previous occupational history consists of one word such as "painter" or "mechanic." Such information is of very little use. If the man had been a painter of the exterior of houses and had used a spray gun but no mask, his greatest hazard would be that of exposure to lead. If, on the other hand, he had been finishing surfaces with lacquers and varnishes in an enclosed space, he may have had hazardous exposure to benzene, toluene, amyl acetate, or certain petroleum solvents. Some painters actually do very little painting and spend most of their time removing paint. If bridge paint is being removed by means of sand blasting, the dangers of lead poisoning and silicosis present themselves. When paint is being removed from furniture or similar articles, by means of a solvent, the danger is that of exposure to the specific organic solvent or mixture of solvents, while the removal of exterior house paint, by scraping, sanding, or burning, involves potentially hazardous exposure to lead dust or fume. The removal of interior paints may not give rise to lead exposure, but may present hazards from other vapors or fumes, and from carbon monoxide. The history must clearly determine exactly what the man did, exactly how he did it, and the period of time involved, since the hazard relates not only to the order of magnitude (concentration) of the exposure to a specific noxious agent, but also to the duration of the exposure. In addition, a careful appraisal must be made of any illnesses he may have had during his previous employment to ascertain their relation to his well as ordinary occupational injury, may be brought to light.

It may be worth while at this point to interject a word of caution occupation at that time. By this technic, peculiar susceptibilities, as with respect to the significance of the history of employment. The facile assumption that a potentially or even theoretically hazardous occupation has given rise to actual hazardous exposure, and that an obscure and ill-defined complaint or illness may be attributed to such an exposure, is a naïve one which can scarcely be said to reveal the inquiring mind and critical judgment so necessary in a competent physician. Unless the examiner is familiar with the operations and conditions of an industrial plant or process, conclusions based on alleged or supposed occupational hazards in that plant or process must remain as tentative as any other untested working diagnostic hypothesis. Many a doctor could save himself from professional embarrassment, and many a controversial and ultimately litigious case might be avoided through the recognition of this simple truth.

A careful appraisal of the applicant's history with regard to accidents both at home and at work is essential. Proneness to accident is usually a psychological defect rather than a physical one. It is usually remediable but it must be recognized.

Nutritional, Systemic and Familial History. A careful nutritional history to determine the exact nature of an applicant's diet is desirable.

Specific information which will measure the applicant's fatigability, mental capacity, reliability and habits of life is essential. A thorough systemic history must be taken because it will be necessary for the examiner to explain and estimate the significance of all minor defects found on physical examination. The familial incidence of allergies, migraine, epilepsy, and tumors, particularly of the skin, lung and genito-urinary tract, are very important in certain types of occupations. Persons with allergic disorders of the respiratory tract and skin frequently do badly in chemical plants. The frequency and severity of attacks of migraine are sometimes increased by exposure to irritant vapors and fumes. Tumors of the skin and of the genito-urinary tract appear to have some hereditary characteristics. Even without definite data to substantiate the risk, it is unwise to expose such subjects in the later decades of life to agents known to be carcinogenic for susceptible animals. With special emphasis on the above mentioned points, the usual medical history will prove entirely satisfactory for pre-employment examinations.

Physical Examination

One does not need to practice medicine for long to learn that routine physical examinations of well people are quite different from the search for the cause of obscure diseases of sick patients. The difference relates to the incentives. The competent industrial physician easily supplies a specific incentive and with it the enthusiasm for thoroughness by knowing in detail the jobs, in relation to which he is performing examinations. Each job requires a special kind of man and the hunt for appropriate characteristics in an applicant supplies the purpose. As an example, one might stop for a moment and ask himself what kind of a person could best do the job of serially numbering the tiny gummed labels for insulin bottles (it is not done by a machine), or what characteristics are needed to clean, efficiently, the outside windows in the Empire State Building. Here, as in the history, a knowledge of the job is essential.

A thorough physical examination will usually fulfill adequately the requirements for pre-employment examination. Certain minor aspects of this physical examination, which may have considerable importance in industrial practice, are overlooked occasionally, even by the most competent examiners. The state of the mucous membranes in the upper regions of the nose, the number and position of the teeth, the degree of mobility of all joints, the state of the arches of the feet and their effect upon posture, particularly upon the position of the pelvis, and minor evidences of cutaneous hypersensitivity such as low grade dermographia, must be carefully sought for. Normally the competent doctor

sees these and other defects but discounts them if they are not the cause of a patient's complaints. In pre-employment examinations one must estimate what significance they may have in relation to the specific occupation in which the applicant desires employment.

Such examinations cannot be completed satisfactorily in the recumbent position. It is necessary to test the mobility of all joints in the upright position, and it is usually desirable to determine the applicant's tolerance for exercise by a short vigorous "hop" test. After the usual examinations have been completed, the applicant should stand nude before the doctor. He raises his arms above his head, then lowers them to a position parallel to the floor. He then wiggles all of his fingers, rotates the wrists clockwise, then counterclockwise, rotates the forearms, flexes the forearm or the arm to the maximal extent, and finally is asked to scratch his back between the shoulder blades first with one hand, then the other. The applicant then squats until his buttocks rest on his heels, rises on his toes and turns around. He is asked to stand on one leg while rotating the other foot, and then to reverse the procedure. Finally he is asked to hop 25 times on one leg after which the pulse is counted immediately and again after one minute. After careful training one can test posture, flat feet, mobility of joints, agility, weakness, balance, coordination, and response to exercise in from one and one-half to two minutes.

Neurological Examination. Routine pre-employment physical examination should include a neurological examination. Without special training in neurology, any intelligent physician can make a neurological examination which will tend to rule out major disorders of the brain and spinal cord. Here again a good history frequently far outranks all the other means of examination in importance. When positive findings are elicited, which cannot be interpreted by the examining doctor, neurological consultation must be obtained. The basic essentials of such a neurological examination are as follows:

Cranial Nerves. (1) The first cranial nerve may be tested easily in rough fashion by determining the patient's ability to determine such common odors as coffee and peppermint.

(2) Visual acuity is tested on the usual eye chart, and ophthalmic examination of the optic disks must be made to determine the presence or absence of papilledema. Only experience will differentiate it from optic neuritis.

(3), (4), (6) The third, fourth, and sixth cranial nerves are tested by carefully observing the shape and reactivity of the pupils and the movements of the eyeballs in all directions. Nystagmus should be looked for during this procedure.

(5) The motor division of the fifth nerve may be tested adequately by asking the patient to open the mouth wide and also to bite down hard, by palpating the tension of the masseter muscle on each side or

asking the patient to protrude the jaw forward, thereby demonstrating the action of the pterygoid muscles. The sensory division of the fifth nerve may be tested by noting the patient's ability to perceive light touch with cotton and the prick of a pin, on the face and on the forehead, and by attempting to elicit the corneal reflex by means of a wisp of cotton.

(7–10) The motor components of the seventh nerve innervate the muscles of expression in the face. Wrinkling the forehead, closing the eyes tightly, and showing the teeth, will demonstrate asymmetry if there is a lesion of this nerve. The auditory division of the eighth nerve is easily tested by the use of a tuning fork or watch, and the vestibular division by the demonstration of nystagmus and the use of the Romberg test. The sensory divisions of the seventh and ninth nerves subserve the function of taste which can easily be measured with such agents as sugar and salt. The motor components of the ninth and tenth nerves are tested together. The person is asked to open his mouth and say "ah." The soft palate should rise in the midline. Any weakness will cause the uvula to deviate toward the unparalyzed side. The examiner then asks him to swallow and notes the power with which the larynx is pulled up during deglutition. Defects in the tenth cranial nerve become apparent as alterations in the autonomic nervous system, involving cardiorespiratory and gastro-enteric responses (i.e. pulse, respiratory rate, and the like).

(11, 12) The eleventh cranial nerve is measured by determining the strength in each trapezius muscle, and the twelfth by noting the subject's ability to protrude the tongue in the midline without deviation or tremor.

General Motor Functions. Spasticity or flaccidity should be sought for, and muscle power tested, in both upper and lower extremities and the back. Tremor and inability to do ordinary fine movements (finger and toe "wriggling") should be tested as well. Abnormality in the way in which an applicant rises from a table or walks demonstrates motor difficulty.

Sensory Examination. A rough sensory examination of the entire surface of the extremities and body should include observation of responses to pin prick, light touch, and vibration. If all three of these sensibilities are intact, no major lesions will be missed. The muscles should be squeezed and any unusual evidence of tenderness noted.

Reflexes. All of the deep and superficial tendon reflexes should be examined. These include the jaw, biceps, triceps, brachioradialis, the upper and lower abdominal, the cremasteric, the knee jerk and the ankle jerk. Certain abnormalities of the pyramidal tracts should be sought for, particularly by the use of the Hoffmann, Babinski, Chaddock and Oppenheim responses.

The above examination, associated with simple memory tests and ordinary conversation to determine the patient's state of orientation, plus careful examination to rule out stiffness of the neck, constitutes a generally adequate neurological examination for the purposes of pre-employment. With practice such an examination can be done in an exceedingly short period of time, in fact within a few minutes.

Routine Laboratory Tests. Because even with careful histories and careful physical examination by competent examiners, certain important items will not infrequently be missed, the routine pre-employment physical examination should include certain laboratory procedures.

X-ray. An x-ray of the chest is the best means of detecting or ruling out minimal active pulmonary tuberculosis. It is also useful in checking the accuracy of the physical findings as to cardiac size and shape, and the condition of the aorta; and it will bring to light deep-seated pulmonary lesions and mediastinal tumors.

Serological Tests. The laudable efforts of the United States Public Health Service to take syphilis out of its "taboo" can be facilitated greatly by the performance of routine serological tests on all applicants. The finding of latent syphilis which can be given adequate therapy is, in the long run, a real service to him who has it. It need not exclude him from employment and it is likely to lengthen his life and prevent early disability.

Urinalysis. The value of routine urine examinations has long been established. The real difficulty arises in industry when albumin or sugar is found in a specimen of urine. Too frequently the cause is not sought and men are rejected on the basis of a single positive result. Like the majority of laboratory data available to the doctor, abnormal findings in the urine constitute only leads calling attention to certain organic abnormalities or corroborating the other evidences of systemic disorders. Albuminuria and glycosuria are not diseases and under certain circumstances may not even represent evidence of disease. The examining physician confronted by such data must find the cause before arriving at a conclusion concerning them. Frequently in industrial practice applicants are sent to their private physicians for such information and for advice concerning it. Often, however, it is desirable and necessary for the industrial physician to investigate the matter thoroughly.

Blood Examination. The advantages of microscopic blood examination in the recognition of anemias, blood dyscrasias, infections and parasitic diseases are too well known to require discussion. The importance of establishing a pre-employment standard with respect to blood findings is not so well recognized and must be emphasized. The variability of these findings in the individual and among groups of persons must be clearly defined if significant changes, which may appear subsequently, are to have any but the most limited meaning.

The *erythrocyte sedimentation rate* is not widely used at present but has been found to be very useful as a screening test to facilitate more accurate diagnosis. Active infections produce an increase in the rate of settling and when an abnormal rate is found the applicant is immediately segregated for more careful study. Frequently lesions which have been overlooked in cursory physical examinations are detected in this manner.

The guaiac test for occult blood in the stool is used largely because abdominal tumors are relatively frequent among the lesions which have been missed in the course of pre-employment and periodic health examinations, and because most of the tumors of the gastro-enteric tract bleed sufficiently to give a positive test. This reaction is not diagnostic of anything except blood in the stool. The blood may have its origin in any place from the mouth to the anus, in bleeding of the nose or gums, in ulcers, tumors, or hemorrhoids. The origin of the bleeding should be found.

Diagnoses Missed. Even in the few instances in which pre-employment examinations are as complete as those described above, it is the general experience of physicians in industry that they fail not infrequently to disclose certain diseases. Commonest among these are silent intracranial and intra-abdominal tumors. Probably not infrequently, low grade infections and infestations of the colon are also missed. However, if such examinations are done with great care, the number of significant errors is small.

Examination Forms. When large numbers of persons are to be examined, it may be necessary or advantageous to break the examination into a number of parts each of which is to be done by separate individuals. Such a procedure inherently hampers coordinated consideration of the findings. For that reason it is necessary to devise examination forms which will require the doctor to give a descriptive summary of the state of each of the systems which he examines. When this technic is used instead of the older "check" systems, fewer sins of omission are committed.

TABLE 1.—*Normal and Abnormal Blood and Urine Lead Concentrations*

	Normal Lead Levels	Safe Abnormal Lead Levels	Hazardous Abnormal Lead Levels
Blood mg. Lead/100 Gm.	0.01–0.06	0.05–0.07	0.07–0.40
Urine mg. Lead/L.	0.01–0.08	0.08–0.14*	0.10–0.80

* A single high urine value associated with a safe or normal blood value may have no clinical significance.

Tests Used in Special Occupations. Over and above the tests included in a thorough pre-employment examination, certain additional observations may be required in relation to highly specialized occupations. For example, when men have had considerable exposure to lead,

blood and urine should be analyzed for lead to determine the significance of their previous exposure before they are accepted for jobs with a similar hazard (Table 1). Again, tests of respiratory function must be made, and x-ray films of the chest must be subjected to an unusually critical interpretation in the case of people whose jobs will expose them to the hazards of the pneumoconioses. Tests of color perception and audition may be necessary for men coming from noisy occupations and applying for work requiring auditory acuity, good vision and equilibrium (aeronautical occupations). It is sometimes necessary to make special circulatory tests to study the adaptability of an applicant to heat and cold and to rapid fluctuation in atmospheric pressure. Special tests of cutaneous susceptibility to the irritant effects on contact with a wide variety of chemical and physical agents, or of special predilection toward specific or non-specific allergic responses on the part of the skin, may be necessary to screen out highly reactive individuals from certain occupations in which cutaneous hazards are prominent. In rare instances it may even be necessary to resort to such complicated procedures as cystoscopy before accepting men of middle age for employment in occupations which will expose them to chemicals predisposing to lesions of the bladder. There is an almost unlimited list of special precautions which occasionally may need to be taken in relation to a specific occupation. They cannot, of course, be made part of the routine examination.

Classification of Employees. Having completed a routine pre-employment physical examination, the industrial physician must decide the question of employability. The answer depends not alone on the existence or absence of certain types of physical defects, but also on the nature of the job for which the man is to be employed. We cannot overemphasize the fact that correlation of all medical data with detailed information about the nature of the job for which the man is applying is of prime importance in determining employability. Particularly in periods of economic stress the wise course is to adopt the realistic and humane attitude that there are but few persons who are completely unemployable. But even under ordinary circumstances it is necessary for industrial management and its medical advisors to recognize that no person who can work with reasonable safety to himself and his associates, should be deprived of the means of earning a livelihood, because of some handicap. It is sound social, economic and medical policy to find the right man for the job and also the right job for the man, as far as it is possible by exercise of the best judgment and skill.

From the data obtained it is possible to classify men for various types of employment in accordance with their physical fitness. The practical scheme for classification given below is similar to that used in a number of large industries.

1. No defects, employable at anything. PQ.

2. Minor readily correctable or relatively insignificant defects: faulty vision, carious teeth, and the like. PQ (Teeth).

3. Major defects requiring employment with limited activity: cardiac conditions, nephritis, and the like. PQX: A, B, C, D: Code No.

4. Unemployable: (a) Temporary—infectious disease. (b) Permanent—psychiatric and malignant disease. NPQ.

PQ means physically qualified. PQ followed by a word in parenthesis indicates a defect which the applicant has been advised to have tended to but which is not disqualifying. Should the defect be latent syphilis, it might appear as PQ (S, 1 wk.). This designation indicates that the man is non-infectious and employable, but that to retain employment he must, within one week, provide a statement from his private physician indicating that treatment has been initiated for this disorder. PQ (glasses 30 days) means employed and will be retained provided he is properly fitted with glasses within 30 days.

PQX: means physically qualified except: Then follows a classification of general limitations; such as heavy work, moderate work, light work, very light work and finally a specific code number delineating more specifically the things a man must not do. The number 350 may mean "stand no more than 25% of the time," 351 "no standing," 352 "no lifting of objects weighing more than 10 lbs.," etc.

NPQ means physically not qualified for work of any kind in a given plant. It may be followed by a T meaning temporary if the examiner thinks that a course of treatment by the private physician might make him employable at a later date.

Such a classification facilitates the selection of men for vacancies of a known type. For example, Mr. Andrews, PQX: D: 350 with fairly well compensated cardiovascular disease, is called when a vacancy arises in the job of watchman or gatekeeper.

During World War II we learned with certainty that in many occupations women are more productive employees than men. In others the reverse situation is true. In small meticulous operations, such as panel wiring or very rapid repetitive operations, women are excellent employees whereas in heavy lifting, hauling or pushing jobs, they are inferior to male employees.

Baetjer has shown that women have a higher absentee rate than men but that the duration of their absenteeism for illness is shorter than that of men. However, one must bear in mind always that many women try to do two jobs: work in the factory and take care of the home. Consideration must always be given to this problem in evaluating women in industry. Excessively long hours may lead to decreased output, increased absenteeism and spoilt work a little sooner in women than in men. The increased disease rate in women is due to increased morbidity from disorders common to both males and females and not primarily to disorders unique to women. In general an increased and abnormal

frequency of menstrual disorders is much more apt to occur in sedentary occupations than in active ones. Accidents are a much less important cause of lost time than illness. Women have a lower industrial accident rate than men and a higher non-industrial rate. There is no reliable evidence to support the commonly held view that women are more susceptible to occupational diseases than men. The pregnant women must be given special consideration and each case must be handled on its own individual merits.

Pre-employment physical examinations give rise to many problems, one of the commonest of which is that concerning dental decay. Should a man who has extensive dental decay be employed? In most instances the consensus of opinion is in the affirmative, sometimes on the condition that the employed man shall have the defects corrected within a specified period of time. In some industries a further step has been taken, and dental services at minimum cost has been made available.

Possibly the most common physical defects found on examination are disorders of vision, most of which can be corrected by glasses. At the present time there is little difficulty in persuading employees to obtain glasses within a reasonable period of time if employment is conditional upon their doing so. Sometimes, however, special arrangements are required in connection with the use of individually corrected goggles or other specialized equipment in the conduct of the day's work.

The problem of hernia in an applicant for a job is often difficult. Persons with existing or potential hernia should be excluded from certain occupations but not necessarily from others. Should a man be forced to have a repair operation before employment is granted and if so what are the chances of recurrence? The employment policy in this instance may well be determined by industrial management on the basis of the risk as established by its experience in such cases. If the policy is to be determined by purely medical consideration, the physician must ascertain in each instance the eligibility of the employee for the specific employment, the feasibility of surgical intervention, and the risk of an operation under the existing conditions with respect to available surgical services. Probably the wisest policy for an industry to follow can be arrived at by an agreement between the management, the employees, and the industrial physician in which the responsibilities of each are considered on the basis of local conditions.

Active pulmonary tuberculosis should always be a reason for rejection. The same applies to infectious syphilis. Non-infectious syphilis, on the other hand, usually does not constitute a reason for rejection, provided the employee agrees to take prompt and adequate therapy. An exception to this rule should be made in the case of neurosyphilis, which is valid cause for rejection unless adequate and effective therapy has been instituted. Partial or impending disability such as moderate hypertension, flat feet, nocturia, missing digits, asthma, hay fever, heart

trouble, diabetes, and others too numerous to mention, may justify rejection for certain jobs but not for others. No fixed criteria can be set for any one of them.

Periodic Examination

The problem of periodic health examinations in industry is by no means an easy one. Considering the field as a whole, such examinations may be said to serve several purposes: (1) They should be utilized to prove the efficacy of measures the purported function of which is to prevent occupational injury. (2) They may be utilized in specialized form to demonstrate the existence of subclinical intoxication of hazardous occupational exposure before actual cases of disability arise. (3) They may be used to protect the general plant population against communicable diseases which may occur from time to time among individuals or small numbers of employees, and which, otherwise, might go unrecognized. (4) They may be utilized to eliminate occupational risks which arise not from changes in the character of the occupation but from the changing efficiency (aging, etc.) of the employees. (5) They may be effective in picking up hitherto unrecognized occupational hazards. As with other examinations they must be done with a purpose to be of optimal value. (6) They have a significant maintenance value, in a certain proportion of cases, especially among executives, as a means of arresting the progress of disease; and also of limiting excessive physical and mental wear and tear when the causes of the latter can be established and eliminated.

The scope of such examinations is no less of a problem. From a purely practical point of view they should not duplicate the pre-employment examination. If they were to do so, they would fail to fulfill their most important function in many instances, and there would be a very real danger that such a procedure might contribute unfavorably to the incidence of neuroses, especially if examinations were made at too frequent intervals.

Frequency of Examinations. What should their frequency be? No one knows. Dr. A. G. Kammer has demonstrated, on the basis of the incidence of tuberculosis alone, that five years is too long a period between examinations. There is a considerable amount of evidence to indicate that for psychological reasons six months is too short an interval, in the case of comprehensive examinations.

It is the opinion of the author that the frequency of such examinations usually is, and should always be, dictated by the magnitude of the occupational hazards and by careful medical study of the situation within a given industry, with respect to the specific problems that present themselves. There is not now—and probably never can be—any hard and fast rule.

Table II—*Tests to Determine the Presence of Toxic Agents in Biologic Materials*

Toxic Agent	Biologic Material Used for Analysis	Mean Values and Range of Normal Subjects	Methods of Analysis
Lead	Blood	0.03 mg./100 ml. (0.01–0.05)	(1) Dithizone
	Urine		(2) Lead chromate
	Feces	0.03 mg./1 (0.01–0.08)	(3) Spectrographic
Mercury	Urine	None	(1) Dithizone
			(2) Spectrographic
Arsenic	Hair (Pubic)	30 p.p.m.	(1) Gutzeit mercuric bromide method
	Urine	0–0.85 mg./1	
	Feces		
Manganese	Blood	0.014 mg./100 cc.	Colorimetric method
	Urine		
Fluoride	Blood	0.01 mg./100 cc.	Volumetric method
	Urine	0.2–0.4 mg./1	
Radium	Exhaled air	None	Ionization chamber
Selenium	Urine	0.04–0.05 mg./1 range (0–0.15 mg./1)	Electrotitrimetric modification of the iodine-thiosulfate method
Carbon monoxide	Blood	1.5% CO-Hb (Nonsmokers)	(1) Spectrophotometric
		3–10% CO-Hb (Smokers)	(2) Van Slyke-manometric method (Roughton)
			(3) Pyrogallic tannic acid method

Copied from Johnstone, R. T., Occupational Medicine and Industrial Hygiene, St. Louis, The C. V. Mosby Company, 1948, p. 82.

Types of Examinations. Space does not allow us to discuss in minute detail the various types of procedures which may be used in periodic examinations. Many of them are available in the literature. A simple example may serve to clarify the point. Individuals whose occupation entails exposure to benzol should, and usually do, have a monthly hematologic examination consisting of red, white, and differential counts, and a determination of the hemoglobin. Perhaps no other examination is made at these monthly checkups or perhaps a determination of the relationship of the organic to the total sulfate content of the urine is made at this or some other interval. If at any time any individual shows evidence of hematologic change from the normal established in his pre-employment examination, further investigation of his condition is carried out. In any case, each employee is given an annual complete physical examination in order to check the general status of his health. If in the course of any of the monthly tests evidence of benzene intoxication is found, the employee's work is immediately changed and if there is not a prompt improvement following the cessation of exposure, examination of the bone marrow may be necessary and the proper therapy is instituted at once. In the instance of any specific type of highly injurious agent to which men in industry may be exposed,

some specialized procedure or group of procedures can generally be found, which may be used in this manner. Gafafer et al., in a "Manual of Industrial Hygiene," discuss symptomatology, therapy, and control of the principal occupational diseases in such a manner as to indicate many of the specific or recommended procedures.

Experience has shown that, where it is possible, a laboratory procedure of a reasonably specific nature is the method of choice when periodic examination must be made rather frequently. Also, there is the curious added advantage that such a procedure acts somewhat as a policeman, not only because of its repetitive character, but also because of the peculiar authority which attaches itself, sometimes falsely, unfortunately, to a "scientific" test. This is not an undesirable feature of such procedures, when it is carried out with adequate precision and interpreted with critical judgment. In tables II, III and IV will be found a summary of laboratory procedures useful both in periodic health surveys and as aids in the etiologic diagnosis of occupational injuries.

Table III—*Tests to Determine the Presence of Conjugated Products*

Metabolic or Conjugated Product (Urine)	Toxic Agents which Produce Metabolic or Conjugated Product	Normal Range	Methods of Analysis
Urinary sulfates	Benzene Aniline Phenol Xylidine	*Inorganic sulfate* Total sulfate ratio, 90%	Folin method
Hippuric acid	(1) Toluene (2) Ethyl benzene and higher homologues which are oxidized to benzoic acid	0.6–0.7 Gm./24 hr.	Crystallize and determine amount by titration with NaOH
Glucuronates	(1) Phenol (2) Terpenes (3) Benzene (4) Xylidine (5) Aniline	0.7–1.4 Gm./24 hr.	Naphthoresorcinol reaction photoelectric absorptiometer
Formic acid	Methyl alcohol	30–120 mg./24 hr. Average, 60 mg.	Dakin method
Thiocyanate	Nitriles	*Serum* Nonsmokers, 0.4–0.6 mg./100 ml. Smokers, 1.5–2.0 mg./100 ml. *Urine* Nonsmokers, 0–085 m./24 hr. Smokers, 14 mg./24 hr.	Colorimetric method for ferric cyanide
2,6 dinitro-4-aminotoluene	TNT		Method of Snyder and von Oettingen
p-aminophenol	Aniline		Aminophenol reaction

Copied from Johnstone, R. T., Occupational Medicine and Industrial Hygiene, St. Louis, The C. V. Mosby Company, 1948, p. 83.

Table IV—*Tests to Determine Physiologic or Organic Changes*

Organ or Tissues Concerned	Agents Involved	Nature of Alteration	Method of Detection
Blood-formed elements	Benzol TNT Arsenic Sulfonamides	—a— Toxic inhibition of blood-forming organs including aplastic anemia and granulocytosis	(a) Complete blood (b) Reticulocyte counts (c) Platelet counts (d) Sternal marrow counts (e) Hematocrit
	Aniline Arsine Lead Nitrobenzene Phenylhydrazine Stibine TNT	—b— Hemolytic	(a) R. B. C. count (b) Hematocrit (c) Hemoglobin (d) Plasma hemoglobin (e) Fecal urobilin (f) Icterus index (g) Stain urinary sediment for hemosiderin in cells
	Radium X-ray	—c— Physical injury (1) External irradiation (2) Internal irradiation	Complete blood count Bone marrow studies
Blood pigments	Aniline Nitriles Nitrobenzene Phenylhydrazine Toluidine Xylidine	Methemoglobin (ferrous Fe in Hb oxidized to ferric Fe)	(a) Gasometric (Van Slyke) (b) Spectrographic (c) Spectrophotometric colorimeter
Liver	(1) Chlorinated hydrocarbons, such as (a) carbon tetrachloride, (b) tetrachlorethane, (c) chloroprene, (d) chlorinated diphenyls, (e) chlorinated naphthalenes (2) Dinitrophenol (3) Dioxan (4) Trinitrotoluene (5) Xylidine	(1) Fatty degeneration atrophy of liver, toxic hepatitis, or cirrhosis	Combination of liver function tests such as: (1) Icterus index (2) Urine bilirubin (Harrison's spot test) (3) Urobilinogen (Watson's method) (4) Hippuric acid excretion (5) Bromsulphalein excretion (5 mg./kg.) (6) Cephalin flocculation (7) Alkaline phosphatases (8) Thymol-barbital
Kidney	Arsine Carbon tetrachloride Chloroprene Cresol Dinitrophenol Dioxan Lead Mercury and bichloride of mercury Nitrobenzene Phenol Turpentine Uranium Vanadium	(a) Nephritis Acute Chronic (b) Necrosis of tubules (c) Fatty metamorphosis of kidney (d) Hemoglobinuric kidney	(1) Routine urinalysis (2) Microscopic for cells, casts, etc. (3) Renal function tests (a) Insulin clearance (b) Urea clearance (c) Dilution-concentration (4) Tests for hemoglobin (a) Benzidine (b) Spectroscopic (5) Stain for hemosiderin in macrophages in urinary sediment

Copied from Johnstone, R. T., Occupational Medicine and Industrial Hygiene, St. Louis, The C. V. Mosby Company, 1948, p. 84.

Examination of the Working Environment

There is no occupation completely free from some form of health hazard. In most, these hazards are slight. Reasonable care in the performance of the day's work, and the maintenance of good housekeeping in the industrial environment will serve to protect employees from injury in most instances. In fairness it can also be said that apparent good health among the employees is evidence, generally, of adequate control of the existing hazards. However, as in other matters, appearances may be deceptive, and especially is this the case when short periods of time are involved. For this reason facts must be established by careful periodic examination of the working environment to determine the nature and magnitude of the hazards and the effectiveness of control measures.

There are many methods by which such studies can be made. One of the useful methods and practical means of studying a specific environmental factor (or a group of such factors), is the determination of the effects upon the group of employees. Groups of men in like occupations are exposed to like hazards. Undue frequency of occurrence of any complaint or physical finding is strong presumptive evidence of the existence of some uncontrolled occupational hazard, and when the nature of the hazard and the effects of exposure are known, the importance of clinical information in determining the protective measures cannot be overestimated. Thus, workmen exposed to potential or actual lead hazards may be examined at regular intervals, the frequency of which will depend upon the severity of the potential exposure. As a checkup on the adequacy of precautionary measures, suggestive symptoms or suggestive evidence of increased lead absorption should lead to investigation of the job and correction of the hazardous exposure before clinical lead poisoning develops. Again, miners in hard rock may well be subjected to annual x-ray examination of their chests as a means of testing the effectiveness of the measures for the control of silica dust and also as a means of recognizing cases of incipient silicosis before it becomes a disabling disease. A further illustration is that of a semiannual cystoscopic examination of men who are exposed to beta-naphthylamine. This procedure may enable the examiner to detect evidence of bladder irritation before cancer makes its appearance. Many other such specialized studies can be made to detect impending or incipient illness and to check the effectiveness of protective measures. Such procedures, however useful, are indirect and are not adequate alone.

Direct measurements of atmospheric contaminants and of other hazardous factors in the industrial environment are the task of the industrial hygiene engineer, a technically trained engineer-chemist with a considerable knowledge of toxicology and, preferably, with some understanding of human physiology. Not infrequently these measurements

must be carried out by the doctor and his nurse or technician, because no industrial hygiene engineer is available. They include measurement of the adequacy of lighting, ventilation, temperature control, humidity control, and sanitary facilities. Impinger types of equipment or specially designed electrostatic precipitators are the tools of choice for catching particulate matter in the air, so that it may be subjected to analysis and toxicologic test. Special devices are available for measuring the concentration of carbon monoxide, mercury, and certain other vapors or gases in the air. Quick field kits have been devised which will permit rapid analysis of air samples for lead and some other metals. Absorbers of all sorts are available for collecting organic vapors and gases from the atmosphere. Precise chemical procedures have been developed for the analysis of mercury atmospheric contaminants. A number of the more commonly used methods of this type are outlined in Table V. Noise and vibration, which lead to fatigue, are measurable by mechanical means. The adequacy of seats, benches, shoes, protective clothing, rest periods, etc., all should be carefully measured by appropriate technics. Bacteriological technics are used to verify the sterility of cutting oils and other lubricants. X-rays are utilized in dust analysis and in the measurement of the effects of stresses and vibration upon building supports. Supersonic waves are used in looking for defects in metals and for precipitating dusts and fibers in preparation for analytical procedures. Many special optical devices are available for studying the adequacy of protective glasses, face guards and screens. Both the sanitary and the nutritional aspects of the food eaten by men in the plant must be studied. Their locker rooms, rest rooms, recreational facilities and clothing need careful scrutiny.

The design of machinery in relation to the user needs continuous study and improvement. Faulty design leads either directly to accidents, or to fatigue which is soon followed by accidents.

Finally, the inter-relationships of men with each other, the attitudes of foremen to workmen and vice versa, and the relationships of management and unions must be studied in detail.

The criteria for safe working environmental conditions have been defined in some instances (see Tables VI and VII) but in others they are not known. Careful studies of the environment and of the employees may need to be combined with animal experimentation to provide reliable data upon which to judge the safety of working conditions. The past experience of the plant with regard to health is a useful but not altogether reliable tool. An appraisal of the status of housekeeping in the plant is an essential part of the examination of the environment.

Classification of Jobs. Following the examination of the environment it is necessary to classify areas and tasks with regard to the type and degree of hazard they present, just as men are classified with regard to their capabilities and limitations. The areas and jobs in the plant,

Table V.—*Outline of Methods of Sampling and Analysis of Air Contaminants*

(Prepared by Senior Chemist F. H. Goldman, Division of Industrial Hygiene, National Institute of Health, Bethesda, Md., March, 1943.)

Constituent	Sampling Method	Analytical Method
Acetone	Bubbler with alkali: 5% sodium hydroxide	Iodometric
Acid fumes	Bubbler with (a) water (b) alkali (N/200 NaOH)	(a) Titration or determination of anion or pH determination (b) Titration or determination of anion
Alcohol	Bubbler with 1.5% $K_2Cr_2O_7$ in 1:1 H_2SO_4	Chromate reduction
Alkali mists	Bubbler with (a) water (b) acid (N/200 HCl)	(a) pH determination (b) Titration
Ammonia	Bubbler with acid (N/200 HCl)	Nessler's reagent (Distill from alkali if necessary)
Ammonium chloride	Midget impinger	Nessler's reagent (Distill from alkali if necessary)
Ammonium nitrate	Midget impinger	Phenoldisulfonic acid
Ammonium picrate	Midget impinger	(a) Colorimetric (b) Distill from alkali: Nessler's reagent
Aniline	Fritted bubbler with 1:100 H_2SO_4	Colorimetric with $CaOCl_2$—phenol
Antimony dusts	Midget impinger	(a) Colorimetric Rhodamine B (b) Spectrographic
Arsenic dust	Impinger	Gutzeit
Arsenic fumes	Electrostatic precipitator	Gutzeit
Arsine	Test paper with mercury bromide	Visual
Benzol	(a) Indicator (b) Mercury seal flask (c) Sampling bottle with 2 ml. sulfuric-fuming nitric acid (d) Special bubbler with nitrating acid ($HNO_3 + H_2SO_4$)	(a) Visual (b) Absorption spectrum (c) Colorimetric or titration with titanous chloride (d) Colorimetric or titration with titanous chloride
Cadmium	(a) Impinger (b) Precipitator	Cadmium sulfide or dithizone
Carbon bisulfide	(a) Bubbler with 5% KOH (b) Bubbler with diethylamine copper acetate reagent at 60 ml. per minute	(a) Ethyl xanthate (b) Colorimetric; may be compared immediately without any additional chemical operations
Carbon monoxide	(a) Indicator (b) Sampling bottle	(a) Visual (b) Iodine pentoxide
Chlorine	Bubbler with o-tolidine solution	Colorimetric (Immediately in the field)
Chlorine dioxide	Bubbler with 5% KI solution	Iodometric
Chlorinated hydrocarbons	(a) Two bubblers in series with amyl acetate (b) Halogenated combustion apparatus (c) Silica gel	(a) Chemically after burning (b) Volumetric Volhard or gravimetric AgCl (c) Chemically from silica gel
Chromic acid mists	Impinger with alkali (5% NaOH)	(a) Iodometric (b) Colorimetric
Cyanide	Bubbler with alkali (5% NaOH)	(a) Volumetric } Best immediately (b) Colorimetric }

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(Table V—*Outline of Methods of Sampling and Analysis of Air Contaminants*—Cont'd)

Constituent	Sampling Method	Analytical Method
Dimethyl aniline	Fritted bubbler with 1: 100 H_2SO_4	Colorimetric as the nitroso derivative
Diphenylamine	Fritted bubbler with 1: 100 H_2SO_4	Colorimetric with Fe
DNT (dinitrotoluene)	(a) Fritted bubbler or impinger with diethylaminoethanol (b) Fritted bubbler or midget impinger with alcohol	Colorimetric
Esters	(a) Vacuum bottle (b) Charcoal tube (c) Benzol indicator	(a) Iodine pentoxide (b) Gravimetric (c) Visual (special calibration)
Ether	(a) Benzol indicator (b) Bubbler with alcohol	(a) Visual (special calibration) (b) Volumetric after hydrolysis
Fluorides (a) Dusts (b) Fumes (c) Vapors	(a) Midget impinger (b) Electrostatic precipitator (c) Fritted bubbler	Titrate with thorium nitrate or colorimetric
Formaldehyde	(a) Impinger with 1% sodium bisulfite (b) Impinger with 1.25% KOH	(a) Volumetric estimation of sulfoxalate formed (b) Polarigraph or colorimetrically by Schryver method
Hydrogen sulfide	Bubbler with cadmium chloride	Iodometric
Lead	(a) Impinger with 1: 100 HNO_3 (b) Electrostatic precipitator	Colorimetric-dithizone Chromate (gravimetric)
Lewisite	Fritted bubbler with 5% NaOH	Chemical determination of chloride
Magnesium	Midget impinger	Spectrographic
Manganese	(a) Impinger (b) Precipitator	Colorimetric
Mercury	(a) Detector (b) Midget impinger	(a) Visual (b) Colorimetric by dithizone
Metal fumes	Electrostatic precipitator	Chemical or spectrographic
Methanol	Bubbler with 5% alkaline permanganate	Colorimetric
Methyl butyl ketone (butanone)	Bubbler with 5% NaOH	Iodometric
Methyl cellusolve	Bubbler with 1.5% $K_2CR_2O_7$ in 1: 1 H_2SO_4	Colorimetric or iodometric
Mono-oil (Mononitrotoluene)	Gas sampling tube and 2 ml. nitrating acid	Colorimetric or titration with $TiCl_3$
Mustard gas (Dichlorodiethylsulfide)	Fritted bubbler with 5% alkali	Determine chlorides after hydrolysis
Naphtha	(a) Benzol indicator (b) Charcoal	(a) Visual (special calibration) (b) Gravimetric
Nitrobenzene	Sampling bottle with 2 ml. nitrating acid	Colorimetric or titration with $TiCl_3$
Nitroglycerine	Fritted bubbler with triethylene glycol	Colorimetric with xylenol
Nitrogen oxides	Sampling bottle with 10 ml. N/10 H_2SO_4 with 3 drops 3% H_2O_2	Colorimetric with phenoldisulfonic acid

(*Continued Next Page*)

(Table V—*Outline of Methods of Sampling and Analysis of Air Contaminants*—Cont'd)

Constituent	Sampling Method	Analytical Method
Pentaerythritol	Midget impinger with 1.5% $K_2Cr_2O_7$ in 1: 1 H_2SO_4	Colorimetric
PETN (Pentaerythritol tetranitrate)	Fritted bubbler with triethylene glycol	Colorimetric with xylenol
Phenol	Bubbler with 5% NaOH	Colorimetric
Phosgene (Carbonyl Chloride)	Bubbler with 5% NaOH	Chemically for chlorides
Phosphine	(a) Bubbler (b) Test paper with $AgNO_3$	(a) Chemically (b) Visual
Potassium chlorate	Impinger	Volumetrically with $FeSO_4$ and $KMnO_4$
Propylene glycol	Bubbler	Iodometric using periodate reagent
Solvent vapors	Benzol indicator	Visual (Special calibration)
Sodium oxalate	Fritted bubbler	Chemically: titration with $KMnO_4$
Strontium salts	Impinger	Spectrographic
Sulfur chloride	Bubbler with 5% alkali	Chemically: Volumetric
Sulfur dioxide	Bubbler with 5% alkali	Chemically
Tetryl	(a) Midget impinger with 1: 100 H_2SO_4 (b) Midget impinger with diethylaminoethanol	(a) Colorimetric with alkali (b) Colorimetric
Toluol	(a) Benzol indicator (b) Mercury seal flask (c) Sampling bottle with 2 ml. nitrating acid ($HNO_3 + H_2SO_4$)	(a) Visual (Special calibration) (b) Absorption spectra (c) Colorimetric or $TiCl_3$ titration
Triethylene glycol	Bubbler with $K_2Cr_2O_7$ in 1: 1 H_2SO_4	Colorimetric or volumetric
TNT (Trinitrotoluene)	(a) Midget impinger with alcohol (b) Midget impinger with diethylaminoethanol	Colorimetric
Zinc	Precipitator or impinger	Chemically

Unless otherwise stated sampling rates are:

(a) Impinger	1 cubic foot per minute
(b) Midget impinger	0.1 cubic foot per minute
(c) Bubbler	0.5 to 1 liter per minute

In cases where homogenous solutions are obtained due to solubility or reaction of the constituent with the sampling media, rinsings should *not* be combined with the sampling media but the *volume* of sample liquid should be recorded. This avoids unnecessary dilution of the sample.

In cases where the midget impinger is used with media other than water, it is preferable and sometimes absolutely necessary to use all-glass apparatus. If rubber must be used, then samples should be transferred to all-glass containers immediately after sampling.

The collecting medium is water unless otherwise stated.

Where fritted glass bubblers are used, the porosity is *coarse*.

Copied from Johnstone, R. T., Occupational Medicine and Industrial Hygiene, St. Louis, The C. V. Mosby Company, 1948, pp. 532–534.

Table VI—*Suggested Maximum Permissible Concentrations*
(Toxic Thresholds)

Substance	Unit of Measurement	Limit
Dusts:	Million particles	
Total Dust (0.5 to 10.0 microns)	per cubic foot (except as specified below)	50
Mineral Dusts (0.5 to 10.0 microns)		
Asbestos	"	5
Cement	"	15
Silica (less than 10%)	"	50
Silica (10% to 50%)	"	10
Silica (more than 50%)	"	5
Slate	"	15
Talc	"	15
Metallic Dusts and Fumes:		
Cadmium	Milligrams per cubic meter	0.1
Chromium (acid, chromate or dichromate)	"	0.1
Lead and lead compounds	"	0.15
Manganese	"	6.0
Mercury	"	0.1
Total metal fumes	"	30.0
Zinc oxide fumes	"	15.0
Miscellaneous Dusts and Fumes:		
Chlorides (fumes)	Parts per million	15.0
Chlorinated diphenyls	"	1.0
Chlorinated Naphthalenes (except Trichloronaphthalene)	"	1.0
Fluorides (dusts and fumes)	"	2.0
Tetryl, T.N.T. and D.N.T.	"	1.5
Trichloronaphthalene	"	10.0
Gases and Vapors:		
Acetate, amyl	Parts per million	400
Acetate, butyl	"	400
Acetate, ethyl	"	400
Acetate, methyl	"	400
Acetate, propyl	"	400
Acetone (see Ketones)		
Acetylene	Use explosive limit	
Acids		
Hydrochloric acid	Parts per million	10
Hydrogen cyanide	"	20
Hydrogen fluoride	"	3
Nitric acid	"	10
Sulfuric acid	"	10
Acrolein (see Aldehydes)		
Acrylonitrile	"	20
Alcohol, amyl	"	200
Alcohol, butyl	"	200
Alcohol, ethyl	"	1000
Alcohol, methyl	"	200
Aldehydes, total	"	10
Acrolein	"	1
Formaldehyde	"	10
Ammonia	"	100
Aniline	"	5
Arsine	"	1
Benzol	"	100
Bromide, methyl	"	30
Bromine	"	1
Carbon dioxide	"	5000

(*Continued Next Page*)

Table VI—*Suggested Maximum Permissible Concentrations*—(Cont'd)

Substance	Unit of Measurement	Limit
Carbon disulfide	"	20
Carbon monoxide	"	100
Carbon tetrachloride	"	100
"Cellosolve" (See Glycols)		
Chlorine	"	1
Chloroform	"	100
Cyanogen and compounds	"	20
Dichlorobenzene	"	75
Dichloroethylene	"	200
Dichloromethane	"	200
Dimethylaniline	"	5
Ether, ethyl	"	400
Ethylene dichloride (dichloroethane)	"	100
Ethylene oxide	"	250
Formaldehyde (see Aldehydes)		
Gasoline	"	1000
Glycols		
Diethylene glycol monoethyl ether ("carbitol")	"	50
Ethylene glycol monobutyl ether (butyl "cellosolve")	"	50
Ethylene glycol monoethyl ether ("cellosolve")	"	500
Ethylene glycol monoethyl ether acetate ("cellosolve" acetate)	"	50
Ethylene glycol monoethyl ether (methyl "cellosolve")	"	50
Hydrogen cyanide (see Acid)		
Hydrogen fluoride (see Acid)		
Hydrogen sulfide	"	20
Ketone, dimethyl (acetone)	"	500
Ketone, methyl butyl (hexanone)	"	500
Ketone, methyl ethyl (butanone)	"	500
Ketone, methyl isobutyl (hexanone)	"	500
Ketone, methyl propyl (pentanone)	"	500
Monochlorobenzene	"	75
Nitrobenzene	"	5
Nitrogen, oxides of	"	25
Ozone	"	1
Phosgene	"	1
Phosphine	"	1
Phosphorus trichloride	"	1
Styrene monomer	"	400
Sulfur dioxide	"	10
Tetrachlorethane	"	10
Tetrachlorethylene (Perchlorethylene)	"	200
Toluol (Toluene)	"	200
Trichlorethylene	"	200
Turpentine	"	200
Vinyl cyanide (see Acrylonitrile)		
Xylol (Xylene)	"	200

Copied from Johnstone, R. T., Occupational Medicine and Industrial Hygiene, St. Louis, The C. V. Mosby Company, 1948, p. 573–74.

classified as to their hazards and the types of employees which they require, are then brought to the attention of those responsible for operating procedures and equipment. Ways and means must be devised to make the operations safe. The various technics used to accomplish this goal are myriad. Sometimes a building must be redesigned. Sometimes a machine is altered or guarded. Sometimes the protection is applied to the man himself. These technics are in the province of the engineer. Their adequacy in protecting the health of employees is in the province of the industrial physician.

For a variety of reasons, in some occupations it has been impossible to bring certain hazards under adequate control. In these the technic of rotation of men so that exposures are short may be quite effective. Premedication against the effects of hazardous exposures, such as the administration of salt to prevent heat cramps in hot mills, may also

Table VII—*Lower Explosive Limits of Inflammable Vapors*

Gas or Vapor:	Per cent by Vol.	*Gas or Vapor:*	Per cent by Vol.
Acetaldehyde	4.0	Ethylene oxide	3.0
Acetone	2.2	Furfural	2.1
Acetylene	2.3	Gasoline	1.4
Allyl alcohol	3.0	Heptane	1.0
Ammonia	16.0	Hexane	1.2
Amyl acetate	1.1	Hydrogen	4.1
Amyl alcohol	1.2	Hydrogen cyanide	5.6
Amyl chloride	1.4	Hydrogen sulfide	4.3
Amylene	1.6	Methane	5.3
Benzine	1.2	Methyl acetate	4.1
Benzol	1.4	Methyl alcohol	6.0
Benzyl chloride	1.1	Methyl bromide	13.5
Butadiene	2.0	Methyl chloride	8.0
Butane	1.6	Methyl butyl ketone	1.2
Butyl acetate	1.7	Methyl cyclohexane	1.1
Butyl alcohol	1.7	Methyl ethyl ether	2.0
Butylene	1.7	Methyl ethyl ketone	1.8
Carbon disulfide	1.0	Methyl formate	5.0
Carbon monoxide	12.5	Methyl propyl ketone	1.5
Cellosolve	2.6	Naphthalene	0.9
Cellosolve, acetate	1.7	Nonane	0.7
Cyanogen	6.6	Octane	0.8
Cyclohexane	1.3	Pentane	1.4
Decane	0.7	Propane	2.4
Dichlorethylene	9.7	Propyl acetate	2.0
Diethylene oxide	2.0	Propyl alcohol	2.5
Ethane	3.2	Propylene	2.0
Ethyl acetate	2.2	Propylene dichloride	3.4
Ethyl alcohol	3.3	Pyridine	1.8
Ethyl bromide	6.7	Stoddard's solvent	1.1
Ethyl chloride	3.6	Styrene monomer	1.1
Ethyl ether	1.7	Toluene	1.3
Ethyl nitrate	3.8	Turpentine	0.8
Ethyl nitrite	3.0	Vinyl chloride	4.0
Ethylene	3.0	Xylene	1.0
Ethylene dichloride	6.2		

In addition to the table regarding toxic substances, each state has its own regulations as to the safe conduct of many industries. These are available to the industrial physician.

Copied from Johnstone, R. T., Occupational Medicine and Industrial Hygiene, St. Louis, The C. V. Mosby Company, 1948, p. 575.

be an effective method when the more desirable preventive measures are not possible. A reasonable effort founded upon correct information and carefully safeguarded against the mistakes and omissions that arise from too great dependence on human care and persistence, usually results in adequate control of industrial hazards except in the case of two classes of employees, namely, new employees ("green" help) and fatigued employees. With the new employee, lack of familiarity with the job and with the use of protective measures leads to injury. Exceedingly careful instructions by foremen and the discouragement of "horse play" among seasoned employees minimize the dangers. Men who are fatigued become careless or awkward and make mistakes they would not normally make. In a well controlled plant a sudden increase in the incidence of injuries in an established process previously recognized as safe is likely to have its origin in fatigue. Within the field of application of laws or agreements regulating the hours of work this factor tends to be eliminated in large measure, but unusual conditions may sometimes bring about greatly increased tension. Moreover, industrial management is not so protected. Medical men should be on the alert for evidence of fatigue in management and executives during period of unusual pressure.

Despite careful attention, illness and accidents occur periodically in every occupation. These may be due to carelessness, to idiosyncrasies on the part of employees, to unrecognized hazards, or to the familiarity with hazards that breeds disregard of them. Long and careful study is frequently necessary to find the cause. In the chemical industries the toxicity of many an ingredient, intermediate or final product is not known in sufficiently precise terms. Toxicologic investigations and other types of clinical and laboratory investigations in relation to industrial materials and processes are yet to be made. Medical research has largely overlooked this enormous and fertile field for the study of all types of disease in mass populations.

Atomic Energy

The principles necessary to the proper management of the health of those who deal with nuclear energy are no different from those previously outlined. However, they must receive special attention because here the hazard is tasteless, odorless, colorless, invisible, inaudible, and otherwise insidious. Secondly, the degree of the daily exposure to nuclear energy required to produce serious disease is extremely small. And thirdly, a new and at present rather complicated set of technics have had to be devised to deal with the problem. The industrial hygiene engineer of the Atomic Energy Industry is commonly called a Health Physicist because of the special background he must have to perform his tasks. Fortunately, prior unfortunate experience with related forms of energy had demonstrated the existence of serious hazards in this industry at

its outset, and therefore no step was taken in the Manhattan Project without first giving very careful consideration to its health aspects. The chief new technic of control has been called monitoring. Every person, every task, every ingredient, every product (useful or waste) in connection with the atomic energy industry must be measured (monitored) for the amount and type of radiation received or given off. Rigid rules have been established for the industry and for all who use isotopes for investigative purposes. Because so many physicians in and out of industrial practice are coming into more and more frequent contact with this problem, it is thought wise to include these general rules and procedures as supplied by the United States Atomic Energy Commission in the Isotopes Branch Circular B-1 revised August 1947.

GENERAL RULES AND PROCEDURES CONCERNING RADIOACTIVE HAZARDS

INTRODUCTION

Information in the following pages has been compiled from "Standard Safety Requirements," AEC Regulation, Safety No. 3.

These general rules may be used primarily as a guide by those who are devising more specific regulations for their own laboratory. Laboratories conducting work with radiomaterials should have access either directly or indirectly to the services of adequately trained and equipped technicians who will supervise health monitoring and accept responsibility for conformation with health-safety practices.

The Advisory Field Service Section or the Technical Section of the Isotopes Branch will be pleased to give you advice and assistance on health problems associated with work in your investigation. The expert services of technical and professional assistants in the Isotopes Branch will be made available for field consultation in cases where this appears desirable.

Articles which may be useful in the design of safe laboratory facilities and in health-physics have been published under the following titles:

Henri A. Levy, "Some Aspects of the Design of Radiochemical Laboratories," *Chemical Engineering News*, Vol. 24, p. 3168, Dec. 1946.

W. H. Sullivan, "Control of Radioactive Hazards," *Chemical Engineering News*, Vol. 25, p. 1862, 1947.

K. Z. Morgan, "The Responsibility of Health Physics," *Scientific Monthly*, Vol. 63, p. 93, 1946.

K. Z. Morgan, "Tolerance Concentrations of Radioactive Substances," *PB 52766*, U. S. Dept. of Commerce, Office of Technical Services.

J. E. Wirth, "Essential Safeguards in Production and Use of Atomic Energy," *Occupational Medicine*, Vol. 2, p. 428, 1946.

GENERAL RULES AND PROCEDURES CONCERNING RADIOACTIVE HAZARDS

A. *Tolerances (Maximum Permissible Exposure)*

1. The tolerance level for total or limited body exposure is 0.1 rem. (roentgen equivalent man)* in any 24 hour period. No individual shall knowingly expose himself or cause others to be exposed to greater than this quantity in any 24 hour period. It is advisable, however, to strive for the lowest possible daily total exposure in every operation. The 0.1 rem. represents the total additive exposure from the independent components of all radiation involved. The relationships between r (roentgen),* rem (roentgen equivalent man),* and rep (roentgen equivalent physical)* in accordance with present data are considered as follows:

Type of Radiation	*roentgens*	*rem*	*rep*
X-ray	0.1	0.1	0.1
gamma	0.1	0.1	0.1
beta	—	0.1	0.1
alpha†	—	0.1	0.01

* See Appendix A—Definition of terms.

† Considered from the standpoint of internal effects only.

2. Tolerance level for beta and gamma emitters:
   a. *Air contamination:* The tolerance level for the most hazardous and common beta-gamma radioisotopes (such as iodine, strontium, barium, etc.) is considered to be about 10^{-7} microcuries/cc of air. If one takes the overall collection efficiency of the precipitron* (operating at 11.5 cu. ft./min.) and the counter (Eck and Krebs feeding into a scale of 64) to be ½%, this would correspond to about 10,000 c/min. for the collected sample. Therefore, the general rule is to evacuate an area when the counting rate exceeds 10,000 c/min. and to wear masks when the counting rate exceeds 1,000 c/min.
   b. *Water contamination:* (The tolerance level in water for these beta-gamma radioisotopes is considered to be about 5×10^{-4} microcuries/cc of water. This would correspond to about 1100 disintegrations/min./cc (ca 150 beta counts/min./cc for counters used by the technical division).
   c. *Surface contamination:* (As measured with a "standard" counter, or 3¼" from a thin-walled Eck and Krebs counter approximately .005" thick with approximately 5.4 cm^2 flat plate area.)

TOLERANCES (MAXIMUM PERMISSIBLE EXPOSURE)

Item	*Instrument*	*Tolerance Level*
1. Clothing, table tops, body, etc.	Eck and Krebs Counter	500 c/m
2. Hands	Eck and Krebs Counter	700 c/m
3. Smear test on table tops, floors, equipment, etc.	2 sq. in. filter paper smear over 12 sq. in. counted with B and counters	200 counts/min. of β and γ
4. Boxes for shipment by air or rail	Electroscope	β and γ less than 15 mr at the surface of package
5. All laboratory and operating areas	Electroscope, C.P. meters, etc.	All areas with radiation > 12.5 mr/hr shall be roped off and have signs posted
6. Shoe (outside)	Foot counter	30 scaler units = 10,000 counts/min ≅ 14 mr/hr of radiation
7. Shoe (inside)	Shoe probe	1,000 counts/min. ≅ ⅕mr/hr of β and γ
8. Clothing	Laundry counter	500 counts/min ≅ ⅕ mr/hr of β and γ
9. Thyroid	C.M. Probe counter	800 counts/min with counter against throat (≅ 1,000 mr/24 hr in thyroid)

B. *Radiation Monitoring*
   1. Instruments to be used for surveys will be distributed and maintained in calibration by trained technical personnel.
   2. Personnel Monitoring Instruments*
      a. Two pocket chambers* and a film badge meter* are to be worn by everyone who goes within the radiation area except visitors who will wear a film badge meter.
      b. Pocket chambers and film badge meters are not to be tampered with in any way, and are to be used only for personnel monitoring. If a meter is accidentally broken or a cap comes off, it should be returned at once to the point of distribution and a new meter obtained.
   3. Immediate investigation of high pocket meter readings and of high hand and foot counts shall be made by the supervisor of the person concerned and all data recorded.
   4. When an individual, with the aid of his supervisor, is unable to reduce a count below tolerance limits, he shall report to the responsible physician as soon as practical, in any instance before leaving the laboratory.

C. *Protective Clothing and Devices*
   1. Clothing
      a. It shall be the responsibility of the individual and/or his supervisor to see that appropriate protective clothing is worn whenever clothing contamination is probable (laboratory coats, coveralls, etc.).
      b. Coveralls, laboratory coats or other protective garments worn in the restricted area are not to be worn in the cafeteria. This applies to all personnel. Protective

* See Appendix B—Description of equipment.

clothing worn outside the restricted area in connection with work where radioactive contamination is possible shall be governed also by this rule.

2. *Gloves*
   a. Suitable gloves shall be worn whenever hand contamination is probable. Surgical gloves will not stop penetrating beta particles, hence remote handling with tongs and sufficient glassware shielding is necessary in working with strong sources of energetic beta emitters. Surgical gloves can, however, eliminate deposition of active material on the hands.
   b. Surgical technique (See Appendix C-2) shall be used when putting on and removing surgical gloves, in order to avoid the possibility of contaminating the inside surfaces.
   c. Rubber gloves are to be washed and cleaned, if practical, before removal. All rubber gloves are to be stored and handled so as to prevent contamination of the inside surfaces.
   d. Care shall be exercised when using organic solvents to avoid skin contact with radioactive material. (Solvents may make the skin more permeable.)
3. *Respirators, combat mask or air line hoods*
   a. An approved respirator, combat mask or air line hood shall be worn in any location where the concentration of air borne beta and gamma emitters may be greater than 10^{-8} microcuries/cc.
   b. It shall be the responsibility of the supervisor of the area using respirators to see that these are not used more than once before being sent to the contaminated article laundry for monitoring and cleaning (if necessary).
   c. Combat masks and air line hoods (complete sets) shall be monitored and inspected after each use and at two month intervals when not in use.
4. *Equipment and Fixtures*
   a. Hoods in which plutonium (or hazardous beta-gamma material) is actively handled shall be provided with nonporous, inert floors, such as glass, tile or metal; preferably a stainless steel tray should be used to catch possible spills. All work with plutonium, even dilute tracer solutions, shall be done over such surfaces or over heavy kraft or blotting paper to minimize danger from spills. All working surfaces should be of such nature as to be easily decontaminated (nonporous or readily replacable (kraft paper)).
   b. Meticulous care should be taken to see that the moving parts of open centrifuges are maintained free of contamination. Covers of centrifuges handling active materials must not be open while the motor is in motion.
   c. Equipment and laboratory ware contaminated with plutonium (or hazardous beta-gamma material) shall be stored in an operating hood or under water until cleaned.

D. *Eating and Smoking Rules*

1. Eating, storing or preparation of food in a laboratory or operating rooms where active materials are handled is forbidden. The use of milk bottles or other food containers in handling or storing chemicals is forbidden.
2. Smoking must be controlled by local area rules; that is, smoking permitted in certain uncontaminated areas. One of the greatest dangers of smoking is contamination of the cigarette (pipe, etc.) with activity from contaminated hands.

E. *Contamination of persons*

1. Hand and shoe contamination—General
   a. All persons while working with radioactive materials wherein detrimental hand or shoe contamination is possible (as determined by supervision or upon advice of local area Health-Physics representative) are to:
      (1) Keep the fingernails cut short.
      (2) Wash hands thoroughly before eating, smoking or leaving the work area for any purpose.
      (3) Refrain from smoking.
      (4) Wash rubber gloves if practical before removing them from the hands.
      (5) Utilize available hand and shoe counting facilities as frequently as necessary to insure decontamination. (Adjacent to each counter which is reserved for hand and shoe counting there will be a record sheet on which the individual is to record all counts taken; including high counts and those after washing.)
      (6) Report to supervision any hand or shoe count which is above the specified limiting value marked on the counting machine. (If the individual, with the aid of his supervisor, is unable to reduce the count below the limiting value listed on the counting machine, Health Physics or the Medical Department shall be notified as soon as practical, and in all instances before the individual leaves the plant at the end of the shift.)
      (7) No work with plutonium* in any chemical or physical form is ever to be done

* This rule applies to other radioisotopes which present a similar health hazard. (1 microgram Pu — 1/16 microcurie).

by a person having a break in his skin below the wrist or with a bandage on his hand. Any person receiving a puncture wound suspected of hazardous radioisotope contamination shall report to the doctor at the dispensary immediately.

2. Ingestion, inhalation, injection
   a. The pipetting of active solutions by mouth is *forbidden*. Glass blowing in laboratories containing active materials should be discouraged.
   b. Any person who knowingly swallows, inhales or receives an injection of a radioactive material or who may have been overexposed to radiation from any source is to report to the Medical Department at once.

F. *Contamination of Areas*

1. All areas in which there is radiation in excess of 12.5 mr/hr shall be either roped off and appropriate sign posted to prevent persons from coming dangerously close to the radiating source, or, where the hazard is of a permanent nature, permanent signs shall be posted, barricades installed and existing doors locked. Where activity levels are very high, a patrol force guard should be posted to prevent accidental overexposure.
2. Experimental work involving especially hazardous levels of activity shall not be undertaken until suitable protective measures have been agreed upon by the section chief or chief supervisor in charge and the Health-Physics section chief.
3. In case of any permanent change of personnel or permanent vacating of quarters, it shall be the duty of the individual and his supervisor to see that the area is properly surveyed and if necessary, decontaminated before it is vacated.
4. Areas or rooms which are to be kept free from contamination are to be posted with signs on all doors warning persons not to enter with contaminated materials or clothing.
5. A hood containing a high amount of plutonium* contamination must be clearly marked "high level hood." Hoods so designated shall not be repaired or worked on without approval of Health-Physics, which shall specify protective measures for the personnel involved.
6. Spills and contamination levels.
   a. No exposed plutonium* is ever "tolerable"; the following are maximum levels which are perhaps unavoidable in some cases.

	Surface: d/m for 150 sq. cm. (small spots)	Smear: 2 sq. in. counted in std. chamber	Total Contamination (large area)
Exposed surfaces, floors, bench tops, etc.	2,000 d/m	0 d/m	14,000 d/m/sq. ft.
Exposed but protected from handling (roped off, etc.)	10,000 d/m	25 d/m	7,000 d/m/sq. ft.
Inside poor or intermittently used hood	30,000 d/m	25 d/m	280,000 d/m/sq. ft.
Inside adequate hood, operating	(upper limit will vary with area rules and hood efficiency)		

A 2 sq. inch paper wiping a total of 12 sq. inch of tested surface.

   b. All spills of plutonium* must be cleaned up immediately unless inside of adequate hood. Cleaning responsibility shall lie with the operating group in the room and area involved, and they shall check after cleaning to verify that cleaning is thorough. In cases of large spills or if in doubt, call a Health-Physics representative.

G. *The Storage, Handling and Disposal of Radioactive Materials*

1. Storage and handling of plutonium or similar hazardous substances
   a. Quantities of plutonium greater than 1 microgram shall be securely covered during storage and kept in a hood equipped with doors, or in other spaces specifically accepted by the Health Division Director, or his representative, as suitable under the given circumstances. (Such as shelves constructed in an out-pocketing from existing hoods or separate boxes equipped with doors and vented to a proper exhaust.)
   b. All transfer of materials between hoods and storage devices must be done in such a manner as to avoid the possibility of spillage or breakage. Double containers to eliminate contamination and breakage danger should be used.

* This rule applied to other radioisotopes which present a similar health hazard. (1 microgram approximately 1/16 microcurie.)

c. Any work with materials susceptible to atmospheric distribution of plutonium* (that is, dusting, spillage, vaporizing, effervescence of solution, etc.) shall be done in an "adequate hood." (See Appendix A for hood specifications.)

2. *Disposal of materials contaminated with plutonium or similar hazardous substances.* All discarded material which has been liable to plutonium contamination is to be buried. Distinctive cans are to be provided, and these handled with proper discretion. If a dust hazard is involved, a Health-Physics representative shall accompany the can when it is taken to be buried to see that respirators and protective clothing are used when needed. In rooms where large (1 to 2 microgram) amounts of plutonium are handled, a small red closed can should be provided with a paper lining to receive waste of known contamination, so that the closed paper lining may afford some measure of protection against spread at the time of disposal.

3. *Transportation of Active Materials*

a. Off-Site Shipments

(1) Shipment of material by rail or air express must conform with the regulations of the carriers governing transportation of radioactive material.

(2) Sufficient protective means for material shipped by special truck or car shall be used to prevent radiation levels greater than 50 mr/hr at the rear wheels of the truck or car and to prevent levels at the truck cab or driver's seat of a car in excess of 100 mr/day for any persons in the car or cab.

(3) If material is shipped in solution, the vessel containing the solution is to be enclosed in a metal container with a sufficient absorbent material to take up all the liquid in case of breakage of the vessel. The container shall be equipped with a gasketed top. The top should be so constructed that the least amount of exposure is received in removing either the top or the solution. No package shall bear contamination on the outside surface above that specified in Section F 6 for alpha emitters and 500 c/m for beta emitters, as determined from smear tests using standard procedures established by the Health-Physics section.

b. *On Site Shipments or Transfers*

Transportation of active material within or between buildings on the plant must proceed in a manner which will cause no overexposure to any part of the body and will prevent a spill of active solutions.

4. *Disposal of Active Trash, Unwanted Active Materials or Equipment*

a. Two trash cans painted entirely red (both top and can) are to be provided at each desired location for trash which is contaminated.

b. Only *one* of these two cans should be used at a time and the one in use should be tagged by Supervision of the Area—"Use This Can."

c. It shall be the responsibility of supervision to see that these cans are monitored at sufficiently frequent intervals to prevent active materials from accumulating to such an extent that radiation levels of greater than 12.5 mr/hr occur.

d. Once a can has been labeled "Driver, O.K. to Pick Up," no more contaminated trash shall be put in that can. When the can has been emptied and returned, Maintenance should remove the tag so that it may be held in reserve while the second can is in use.

5. *Burying Ground*—All contaminated material and equipment that is to be discarded shall be thrown only in the trenches provided for that purpose.

a. Sufficient earth must cover active materials in a trench to keep the level of radiation at the top of the trench below 12.5 mr/hr.

(1) Keep sufficient earth over trash to prevent trash from being blown or floated outside the trench.

(2) Keep an adequate record of all equipment taken to the burial ground for burial or for storage.

b. The burial ground will be periodically surveyed.

H. *Summary of Responsibilities for the Enforcement of Radiation Rules.*

1. No individual shall knowingly expose himself or cause others to be exposed to more than 0.1 rem in any 24 hour period.

2. In extreme emergencies the acting area head may assume responsibility for a person exceeding 0.1 rem daily exposure provided that:

a. Insufficient time exists to obtain the services of the Health Division for consultation.

b. A written report is submitted within 24 hours to the Plant Director and to the Health Division Director, covering the details concerning the necessity for and the amount of the overexposure, and the precautions taken.

* This rule applies to other radioisotopes which present a similar health hazard. (1 microgram approximately 1/16 microcurie.)

c. The individual or individuals so exposed are sent to the Medical Department as soon after exposure as possible. The Supervisor of each area shall delegate the above authority in his absence.

3. *Supervisors Responsibilities re: Personnel Monitoring Meters*
   a. To see that all persons while working in the restricted area wear meters at all times.
   b. To see that persons working with active materials outside the restricted area wear meters while so engaged.
   c. To request the issuance of permanent meters for employees going into restricted area on an average of more than 3 days per week.
4. *Supervisors Responsibilities re: Protective Clothing.*
   a. It shall be the responsibility of the individual and/or his supervisor to see that appropriate protective clothing is worn whenever clothing contamination is possible.
   b. It shall be the responsibility of the supervisor of the area using respirators to see that these are not used more than once before being sent to the laundry for inspection and cleaning.
   c. It shall be the responsibility of the supervisor of the area using combat masks and air line hoods to notify the area Health-Physics representative after each use.
5. *Miscellaneous*
   a. Supervisors are responsible for maintaining safe radiation levels at the boundaries of their own areas of assigned locations.
   b. Each Area Head or Section Chief shall be held responsible for maintaining recorded surveys of all radiation hazards in the area.
   c. In case of any permanent change of personnel or permanent vacating of quarters, it shall be the duty of the individual and his supervisor to see that the area is properly surveyed and if necessary, decontaminated before it is vacated.
   d. It shall be the responsibility of the supervisor of an area to see that the active waste disposal cans are monitored at sufficiently frequent intervals to prevent active materials from accumulating to such an extent that radiation levels of greater than 12.5 mr/hr occur.
   e. The burying ground is under the 100 Operating area. The supervisor shall see that the top of the trench in which trash is thrown does not exceed 12.5 mr/hr.

APPENDIX A

Definition of Radiation Terms

1. The *roentgen* (= r) is that quantity of *X* or gamma radiation such that the associated corpuscular emissions per 0.001293 gms of air produces in air ions carrying 1 esu quantity of electricity of either sign.
2. *The roentgen equivalent physical* (= rep) is that quantity of ionizing radiation which is capable of producing 1.615×10^{12} ion pairs per gram of tissue or that will suffer an absorption in tissue of 83 ergs per gram.
3. *The roentgen equivalent man* (= rem) is that quantity of radiation which when absorbed by man produces an effect equivalent to the absorption by man of one roentgen of *X* or gamma radiation.

APPENDIX B

Personal Monitoring Meters

1. The *Victoreen Pocket Meter* is a small air ionization chamber or air condenser. It has a full scale reading of 200 mr when charged and read on the minometer in use at Clinton Laboratories. When it is carefully used, it usually gives an error less than 5% of full scale. It is charged at 143 volts and does not give saturation errors unless subjected to extremely high fluxes (of the order of 10 mr/second). It has a bakelite wall thickness of 0.172" and so cannot be used for beta ray measurements if the energy is less than one mev. The minometers are calibrated with 200 KV *X*-rays so that the pocket meters read low by about 20% for radium gamma rays (1.8 mev). The meters will discharge, giving "false readings" when given extremely rough treatment or dropped.
2. The *Badge Meter or Film Meter* contains an open window and a cadmium shield. A dental size film packet holding two films, one a sensitive (0–5 r) and the other an insensitive film (0–20 r), is placed in this meter by the personnel monitoring girls of the Health-Physics section. The open window may give an indication of the beta exposure but is difficult to interpret if low energy gamma radiation is mixed with the beta rays because the film is 20 times more sensitive to low energy *X*-rays (energy 20 KV) than it is to gamma rays. The readings made behind the cadmium shield are reliable for gamma ray energies down to about 70 KV.

3. *Film Rings* can be used with any of the films described above. They may be obtained by a request to any of the Health-Physics surveyors. They have a very thin (.004″) beta window and some of them are provided with a cadmium shield.
4. *Dose Meters* may be obtained by a request to any Health-Physics surveyor. They are available in the self-charging type or the externally charged variety. They have ranges up to about 200 mr. Their limitations are essentially the same as those of the Victoreen pocket meters.
5. *Precipitron* is an instrument for monitoring the activity dispersed in air as dust, etc. As used on the Project it is a slightly modified form of the electrostatic dust collector manufactured by the Union Mines Corporation. The modifications may consist of a larger air circulation motor and the insertion of a suitable removable sleeve in the cylinder in order to remove collected dust for radiation monitoring.

APPENDIX C

Surgical Technic for Putting on and Removing Rubber Gloves

Surgical rubber gloves, used during procedures where hand contamination is probable, should be prepared in advance by powdering the insides and by folding out the wrist portion of the gloves to form a cuff of about two inches.

To put on the gloves the following procedure is advised:

1. The hands are powdered well with talc.
2. The first glove to be donned is grasped at the folded cuff, without touching the exterior of the glove, and pulled onto the fingers and hand, leaving the cuff in the folded position.
3. The second glove is lifted by inserting the fingers of the gloved hand beneath the cuff, and pulling it onto the bare fingers and hand.
4. The cuffs of both gloves are turned back over the wrists, without touching the bare skin.
5. The loose fitting glove fingers are then "worked" into position in the same manner as are cloth gloves.

Removal of the gloves is accomplished in the reverse order, in that the fingers of one gloved hand grasp the beaded rim of the top of the glove of the other hand without touching the inside of the glove, and by traction, invert the glove and pull it off the hand. The index finger of the bared hand is now inserted beneath the beaded rim of the top of the other glove and without contacting the exterior surface of the glove, it is inverted and pulled off the hand.

APPENDIX D

Recommended Procedure for Washing and Decontamination of Hands

1. Wash thoroughly for two to three minutes by the clock with a teaspoonful of Lan-O-Kleen Soap, using a sufficient amount of tepid (not hot) water to maintain a thin paste, and rub the paste over the entire surface of the hands and fingers. Rinse off completely with water and repeat the process at least three times.
2. If the above procedure is not enough to remove all dirt and contamination, the hands should then be scrubbed for a period of at least eight minutes by the clock with a liquid or cake soap, hand brush, and tepid water, being sure to brush the entire surface of the hands, especially around the nails and between the fingers. Light pressure should be exerted on the brush—do not press so hard that the bristles are bent out of shape. Eight minutes is usually a sufficient time to allow three complete changes of tepid water and soap. Each one of these three washings should be so thorough that the brush will cover *all areas* a minimum of four strokes. A convenient routine is to start by scrubbing one thumb, being sure to brush all surfaces, proceed to the space between the thumb and first (index) finger and similarly to each finger and the webs between the fingers. Attention should be given to the palm and back of the hand and finally additional scrubbing of the nails and cuticles before proceeding in an exact manner with the other hand.
3. Lanolin or hand creams may be used after washing to soften the hands and prevent chapping (keeps cracks from forming through which active material might be absorbed).
4. Additional Method of Decontamination for Fission Products Generally.
   Titanium Dioxide paste (TiO_2)—The material should be made up as a paste or slurry and kept wet with plain or distilled water. It should be applied to the hands as the paste and thinned with tap water while washing. A minimum of 2 minutes of thorough application of this lather to all hand surfaces, especially about the finger nails, is recommended. It should then be thoroughly rinsed off with luke-warm tap water, and followed by a thorough washing with soap and water and a hand brush. If any of the paste is left under the nails after washing, it will form a rather hard cake which is difficult to get off later.

Diagnosis of Occupational Injury

The correct etiologic diagnosis is as necessary in relation to occupational injury as to other types of disease, before intelligent therapy can be instituted.

In traumatic injuries the diagnostic and therapeutic procedures are familiar to all. Such injuries constitute about 90% of most industrial medical practice.

The diagnosis of occupational disease requires a minutely detailed history concerning the exact nature of the occupational exposure of the patient. This history must include every occupational activity since he left school. The history must be meticulous as to detail and all inclusive. In many instances it must be followed by careful scrutiny of the immediate occupation to determine with exactness what agents may possibly have caused the disease. With this information, and after carefully excluding all non-occupational illnesses, the physician makes specific clinic observations (a complete physical examination), as well as chemical and laboratory tests in a properly equipped laboratory (see Tables II, III and IV) to determine which of the possible offenders is at fault. "To assume that a workman has an occupational illness is empiricism; to prove it is a scientific procedure." (Johnstone.)

Not infrequently there are certain obstacles in the way of obtaining an adequate history. First, employees being questioned about the details of their work are frequently hesitant about giving information for fear of losing their jobs. A careful attempt to gain such a patient's confidence is essential. A second difficulty relates to the jargon of industry. Each industry has its own language, and not infrequently employees know only the specialized local terms used in the plant. If the physician does not know this jargon, he may be as much at a loss to determine the facts as if he were listening to a foreign language. Asking patients to describe exactly what they do in simple terms, and to describe the types of machinery commonly used, is helpful. Again, a workman may not know the nature of the agents he handles. In that case one must get the necessary information directly from his employer or from some responsible person at his place of employment. This must be done with tact and judgment, and yet with frankness, if useful information is to be obtained.

Occasionally one elicits a group of unfamiliar physical findings which cannot certainly be attributed to occupational injury, and yet cannot be said not to arise from the occupation. It is usually possible in a situation of this type to make arrangements to examine other men similarly employed. Evidence of similar findings, even in the absence of subjective illness, is useful corroborative information.

There is a strong tendency on the part of inexperienced and somewhat irresponsible physicians to ascribe any unfamiliar or obscure dis-

ease to the effects of an occupation, although they may lack any information as to the hazards of the specific occupation so indicated. Such carelessness frequently leads to serious mistakes and to embarrassing professional complications. Workmen do not suffer from occupational injuries unless the hazards of their occupations are actual rather than merely potential. Exposure to noxious materials must lead to injurious contact or to toxic absorption. There must be evidence on which to judge such matters or the guess of the physicians is little better than that of the layman. Moreover, if the physician is not sufficiently skillful or well informed to elicit or interpret such evidence, he should seek the assistance and advice of those whose experience and training in such matters are superior to his own. In this connection, one's colleagues who are engaged in the practice of industrial medicine, or the physician who is familiar with the industrial plant in which a patient is employed, can reasonably be expected to be in possession of information that will help in arriving at a differential diagnosis. It need not be embarrassing to any physician to admit to some unfamiliarity with the manifold possibilities for occupational injury in relation to complex modern industry. However, it is neither humanly nor professionally wise to make unsupported assumptions or allegations of occupational disease, especially when the procedure for compensating a disabled workman may require the physician to prove his statement or suffer humiliation if he cannot do so.

A more difficult problem is illustrated by the following case. A man has been employed for 20 years in a smelter where he is exposed to manganese fumes. Within the year prior to the onset of his illness, the magnitude of this exposure may have increased because of increased use of manganese. He becomes ill at age 54 with what appears to be Parkinson's disease. A similar syndrome, differing only in the subjective sensory findings, is produced by manganese poisoning. Is this an occupational disease? Careful examination of the case over some period of time usually reveals the answer, but occasionally the results of the most careful study remain equivocal.

In American industries, literally thousands of materials are employed which are potentially hazardous to health. One cannot be expected to have information on all of them at his finger tips. To know the problems of one's own locale is in itself a large task. If, however, one is constantly aware of the possibilities, has good sources of information, and tempers his professional work with critical judgment and modesty, he will experience little serious difficulty.

Space does not permit the inclusion of the diagnostic criteria, clinical and pathological, which may be applied to all of the known nontraumatic occupational injuries. They would fill a large volume and may be found in good textbooks of toxicology and industrial medicine. Each toxic agent when absorbed by the body in quantities sufficient to

disturb normal physiological processes and produce disease, presents a distinct clinical picture which must be learned just as one learns the picture of pneumococcal pneumonia. However, the technics for investigating the functions of each organic system by careful history, thorough physical examination and by the use of a number of special laboratory procedures (Tables II, III, IV) do not differ in principle from those acquired in medical school. Empiricism is more dangerous here than in the field of infectious disease, because, in many instances, if the exact etiologic agent is not precisely identified early, the opportunity to institute specific therapy may have been lost. For this reason, physicians who are unfamiliar with specific occupational disease entities should undertake the handling of such cases with the greatest of reservations. Certainly, despite the fact that there are few specific and effective antidotes for industrial poisons, there are many clinical problems which can scarcely be dealt with or even appreciated except on the basis of experience with these or closely related problems.

Records. Examination of the patient is of temporary benefit to the observer and of no use to any one else unless complete medical records are kept. In the field of occupational injury this is particularly important because nearly every case of disability becomes a medico-legal problem in the eyes of some insurance company or compensation agency. Such records must be clear, concise and accurate. They must state the facts in such a way that the conclusions drawn and the opinions given are obviously justified by the data. Statements of fact should be presented as such. Opinions must be clearly indicated. Results of special diagnostic procedures, such as x-ray examinations, must be securely attached to such records. Just claims for compensation have been disallowed because the physician has not supplied sufficient data to corroborate his contention of occupational injury. Such laxity is directly contrary to the spirit of the Hippocratic Oath and in some instances may actually constitute malpractice.

Ethics. Certain questions of professional practice and ethics present themselves at once in dealing with industrial employees, their illnesses and medical records. These are of considerable significance. To whom should the physician report his findings? Certainly it is a doctor's duty to report his findings in detail to the man examined or to some member of his family. This is done too infrequently, particularly after pre-employment examinations. It may be argued that because the employer stands the expense of the examination, and because it is for him that such examinations are made, that all such data should be turned over to him. The physician will not readily agree with this point of view if he considers carefully his professional status in relation to employee as well as to employer. Not infrequently medical reports in the hands of laymen have been used to the disadvantage of an employee and without his knowledge. The tendency at best, under any

arrangement that puts detailed medical information in the hands of nonmedical persons, is to obliterate a proper doctor-patient relationship.

In some instances labor unions have taken the matter of preemployment medical examinations into their own hands on the ground that the ailments of the applicant are not a matter which need concern the employer; that all the employer needs to know is whether or not the applicant is employable. Here again the situation from the medical viewpoint is very little improved, if the medical records become the property of the union. From the employer's standpoint such an arrangement is manifestly unsatisfactory since he cannot fit the man to a job, and from the employee's it is equally bad since he cannot obtain the medical and hygienic advice he needs in relation to the specific plant or occupation. What is required, obviously, is a relationship between the employee and a physician whereby the former receives advice concerning the nature of his defects and what should be done about them as in private practice. This can be done only if the doctor maintains his records in privacy and guards confidential information in good faith.

Certain other matters will give rise to ethical problems that are distinct from those encountered by the physician in private practice. For example, the responsibility for requiring treatment for certain ailments such as syphilis as a condition to continued employment may be, and often must be, assumed by an industrial physician. This means, of course, that the industrial physician will have to pass upon the adequacy of therapy, determine who is at fault if it is not maintained, and take the necessary steps to accomplish the desired purpose whether that means changing the physician, instituting adequate therapy himself, or bringing about the cessation of employment. Again, if an employee is required to change his job or discontinue it for a medical reason, the situation may be such that the nature of the disability cannot ethically be discussed with an employer without the permission of the offending individual.

The natural desire of employees who like the "company Doc" is to wish to have him treat their families when they are ill. In some companies the industrial physician is a full-time employee and in such instances family practice is forbidden. In others the industrial physician spends part of each day in the plant and the rest of the time in private practice. In still others, particularly in small towns with only one or two industries, there may be no "company doctor" as such. A nurse and a first-aid room are supplied and when a doctor is necessary the patient stipulates who shall be called. All three of these provisions for medical care have advantages and disadvantages both from the point of view of employer and employee.

Occasionally a plant employee may not wish to be taken care of by the industrial physician and may demand his own private physician.

Many employers now recognize the justification for such requests provided the private physician is competent to handle the problem. Such information as is necessary for company records may be obtained from the private physician, who in turn may request the privilege of consultation with the industrial physician as indicated.

When an employee becomes ill the duties of the industrial physician toward his patient's family are exactly the same as they are in private practice. There is no justification for negligence, falsification or secrecy in this matter. The obligation of the physician to his employer does not require an unethical attitude toward the patient or his relatives. Under the most unusual circumstances, should an employer wish to withhhold from a family the facts because of military secrecy or national security, the doctor and a high company official should explain to the relatives of the sick the reasons for such secrecy.

At the present time this idealistic code of ethics is not followed generally in the industries of the United States, but in many, great efforts are being made in that direction. Competent doctors can do much for all concerned by explaining their professional position carefully but forcefully, and by pointing out the advantages of a truly professional industrial medical practice to employers and employees alike. Only highly competent and thorough doctors can inspire complete confidence in themselves and their profession on the part of both management and employees.

Importance of Industrial Medicine. The nature and scope of the work of the industrial physician is in many respects quite different from that of the doctor in private practice, but the methods of approach have much in common. Thoroughness in the performance of duty, complete adherence to the principle of intellectual honesty and finally the desire to be of service, go into the making of excellent doctors in either field.

The great factories of this and other nations could be, but in few instances are, enormous laboratories in which the pathogenesis of disease might be studied under almost ideal circumstances. Here, too, the facilities for the institution of good preventive medicine are at their best. Students in this field quickly learn that much is not yet known, but in most instances are pleasantly surprised at the ease with which many of the answers can be obtained.

To date, the problems of industrial medicine have been omitted from academic teaching of medical students and health officers, largely because the curriculum is already too large and the mass of clinical material so great that the most important problem is to reduce rather than to add to it. Now, however, the true importance of a healthy man at a healthy job is beginning to filter into the medical consciousness, and medicine is beginning to realize that it has neglected one of the major fields.

This paper is but the briefest outline of the nature and scope of industrial medicine, and it is purposefully incomplete, emphasizing only those aspects which, though taught in medical school, are apt to be overlooked as unimportant. It is hoped that it will facilitate an intelligent survey of the field by the student and prove a helpful guide to the physician whose practice is largely or wholly of an industrial nature. The bibliography below lists some of the more important general works on subjects of major importance and each contains good references to more detailed studies of related subjects. One reference (Kehoe) is included to familiarize the student with the practical usefulness of detailed research on the minutia of a single subject (lead poisoning). Without this work, gasoline containing tetraethyl lead could never have come into general use. Tetraethyl lead is an agent more lethal than mustard gas, yet it is handled by thousands without danger.

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MEDICINE

Liver Dysfunction Following Abdominal Operations. The Significance of Postoperative Hyperbilirubinemia. *William Geller, and H. Tagnon, New York, N. Y.* Arch. Int. Med. 86: 908–16, Dec. 1950.

Thirty-three patients undergoing major abdominal operations were studied. Postoperative alteration in results of liver function tests was observed in a high proportion of the patients. The abnormalities were in the sulfobromophthalein clearance in 12 of 22 patients and in the cephalin flocculation of 14 of 22 patients; the changes in thymol turbidity could not be interpreted in view of the high proportion of preoperative abnormalities.

Twenty-four of the 33 had an abnormal serum bilirubin level during the postoperative period, persisting from a few to several days. This was explained by the combination of an increased production of bilirubin associated with blood transfusion and postoperative impairment of liver function.

No satisfactory correlation could be established between the postoperative liver impairment and the character of the operative procedures. The operations were usually of a severe nature and this may explain the high incidence of liver dysfunction observed.

The mechanism of the production of postoperative liver dysfunction is not known. 7 references. 2 tables.—*Author's abstract.*

Nebulized Cortisone in Bacterial Pneumonia. *W. H. Reeder and G. S. Mackey, Detroit, Mich.* Dis. of Chest 18: 528–34, Dec. 1950.

Emphasis of host defense mechanism represents a broadening of the therapeutic horizon from concern with only the etiological factor.

A hyperreactive state not necessarily beneficial may result from bacterial invasion in man. Hyperreactivity may be abolished by Cortisone or ACTH. Topical application suggests a local tissue action of these drugs.

Nebulized Cortisone (1 c.c. of a 4:1 saline dilution of 25 mg.) alone was given an acutely ill patient with type VII pneumococcic right upper and middle lobe pneumonia. Rectal temperature fell from 104.6 to normal in 12 hours with marked subjective improvement. The WBC fell from 18,400 to 8,800 in 24 hours. Blood cultures remained positive. Chest roentgenograms showed no essential change during Cortisone administration. All medications were discontinued for 6 hours and prompt exacerbation of symptoms occurred. Aureomycin therapy and usual supportative measures resulted in termination of the disease. Bronchoscopy after Cortisone inhalation revealed only the usual post-pneumonic mucosa.

The action of Cortisone may have been local in the lungs or systemic from pulmonary absorption. Inhalation of Cortisone appears to be as effective as parenteral administration. Reaction of the host to the disease was favorably influential. The bacterial agent and process of disease was not influenced. Additional comfort and security may be afforded the critically ill patient by the use of Cortisone with appropriate antibiotics. 5 references. 2 figures. 2 charts.—*Author's abstract.*

Granuloma Inguinale and its Treatment with Oral Aureomycin. *Milton Zises and George Smith, Florence, S. C.* Arch. Dermat. & Syph. 62: 642–47, Nov. 1950.

A study is reported in which seventeen cases of granuloma inguinale were effectively treated with oral aureomycin, and followed for one to seven months. Dosage varied between 22.5 g. and 25 g. One relapse was observed. Included is a discussion relating to the clinical description of a granuloma inguinale diagnostic criteria, and supportive therapy. 10 references. 1 table.—*Author's abstract.*

A Clinical Appraisal of Neomycin. *B. A. Waisbren and W. Spink, Minneapolis, Minn.* Ann. Int. Med. 33: 1099–1119, Nov. 1950.

Neomycin, an antibiotic derived from a strain of streptomycetes that is closely related to Streptomycetes fradiae, was discovered by Waksman and Lechevalier in 1949. The results of a trial of this drug in 63 patients having different types of infection including those due to mycobacterium tuberculosis and Proteus vulgaris are presented. Seven cases of tuberculosis were treated and the five cases with meningeal or miliary involvement died. In none of the seven cases of tuberculosis was there any evidence of beneficial response to therapy with neomycin. Tubercle bacilli were cultured from four cases during or after treatment. In three of these four cases significant concentrations of neomycin were demonstrated in the blood and spinal fluid. Neomycin was effective in

the treatment of urinary tract infections due to Proteus vulgaris, Escherichia coli, and Aerobacter aerogenes. It was not always successful in eradicating Pseudomonas aeruginosa from the urinary tract. Definite evidence of a nephrotoxic and ototoxic action of neomycin was found. Fine granular casts were frequently seen in the urine during therapy and patients with renal disease showed marked nitrogen retention when treated with neomycin. Five of the 63 patients developed decreased auditory acuity following the course of therapy. Impaired vestibular function was noted after the onset of the hearing loss.

The uniform failure of neomycin to alter the course of tuberculosis in the seven cases in which it was tried should not cause the trial of the drug in this disease to be abandoned prematurely. In four of these cases streptomycin and promizole drugs that do have a place in the chemotherapy of tuberculosis, were also ineffective.

In the group of cases reported there are some that responded favorably to neomycin when all other antibiotics had failed. In view of this it is unfortunate that because of its ototoxic and nephrotoxic effects neomycin cannot be recommended for general use. 10 references. 5 tables.—*Author's abstract.*

PEDIATRICS

Annual Increment Norms for Ten Measures of Physical Growth on Children Four to Eight Years of Age. *Howard V. Meredith and E. Matilda Meredith, University of Oregon, Eugene, Ore.* Child Development 21: 141-47, Sept. 1950.

Annual increment norms covering the age period from 4 to 8 years of Iowa children are presented for ten measures of physical growth. Description is given of the source and size of the sample, the anthropometric procedures followed in collection of the basic data, and the methods of increment derivation and norm construction. 8 references. 1 table.

Changing Philosophies in Cleft Palate Management. *T. M. Graber, Chicago, Ill.* J. Pediat. 37: 400-14, Sept. 1950.

The author has carried on a study of over 200 cleft palate individuals for the past five years, attempting to appraise the total growth and developmental pattern by means of cephalometric roentgenography. The patients ranged in age from 2 weeks to 77 years, with as many unoperated cases as possible included in the sample. The various components which contribute to facial development were measured and analyzed. Serial studies were projected on a number of the patients, with routine cephalometric x-rays every three to six months.

The results of a complete statistical analysis showed that cleft palate individuals as a group show deficient patterns of maxillary growth in all three dimensions—laterally, anteroposteriorly, and vertically. The greatest departures from the normal were in those patients with early, traumatic and repeated surgical assistance. There was a positive correlation between the number of operations, the amount of scar tissue, and the degree of insult. To minimize interference with growth centers, it seems advisable to postpone surgical correction at least until the end of the fourth year of life, when five-sixths of the total maxillary width has been accomplished. It appears that the surgically repaired palate grows more slowly than the surrounding soft tissue. This results in increasing functional difficulty and ultimate structural inadequacy. Patients whose palatal clefts have not been surgically manipulated show a pattern of maxillary growth that is essentially normal. Closure of nonoperated clefts by prostheses seems successful, if judged by the general intelligibility of speech and ease of mastication and deglutition. Rehabilitation requires the coordination in one organization of all the skills and knowledge peculiar to the cleft palate problem. Only by grouping services and correlating information, can each man render the fullest value of his particular field. 38 references. 28 figures. 1 table.—*Author's abstract.*

Cytological Studies in Association with Local Injections of Streptokinase-Streptodornase into Patients. *Alan J. Johnson, New York, N. Y.* J. Clin. Investigation 29: 1376-86, Oct. 1950.

The introduction of streptococcal concentrates containing streptokinase-streptococcal desoxyribonuclease locally into areas of inflammatory exudation in patients was found to be followed promptly by an outpouring of living polymorphnuclear leukocytes; this usually reached its maximum 24 hours after the injection.

Changes in the local cytologic pattern caused by the injection of the enzymes were characterized by a marked decrease in degenerating and degenerated cellular forms and a rapid rise in supra-vitally staining, motile, phagocyting leukocytes.

Since the concentrates employed contained mixtures of streptokinase and streptococcal desoxyribonuclease, the extent to which each individually contributed to the cellular reaction has not been determined. However, in four instances in which both enzymes, inactivated by heat, were injected locally in patients, minimal cellular reaction was observed.

Depolymerization of desoxyribonucleic acid effected by treatment with streptococcal desoxyribonuclease caused a breaking-up of clumped

leukocytes, the conglomeration of which was apparently due to a matrix of desoxyribose nucleoprotein. Liquefaction of highly viscous purulent fluid by streptococcal desoxyribonuclease, as evidenced by preparations stained by the Feulgen method, resulted in the disappearance of extracellular desoxyribonucleic acid and the nuclei of degenerating cells. The nuclei of living cells remained intact. Biochemical evidence of depolymerization accompanied the cytologic changes. 29 references. 5 figures. 1 table.—*Author's abstract.*

Growth and Development of Negro Infants. *Althea Kessler and Roland B. Scott, Washington, D. C.* Am. J. Dis. Child. 80: 370-77, Sept. 1950.

This study is an attempt to determine the effect of economic status on birth weight, body length, and osseous maturation of newborn Negro infants. Ossification is more advanced in infants of greater birth weight and length, more advanced in females than in males of the same birth weight, and more advanced in Negro than white infants.

The subjects were 300 normal newborn Negroes weighing 2,268 Gm. or more. X-rays of the infant's right knee were taken and the diameters of the distal femoral and proximal tibial epiphyses were measured. For evaluation of economic status, cases were grouped according to hospital pay status as follows: (1) private patients delivered by members of the obstetrical staff; (2) patients on the ward service who were paying for hospitalization; and (3) free or indigent patients. A group whose milk intake had averaged one quart or more daily throughout pregnancy were compared with another group who had averaged less than one pint of milk daily.

The mean size of both centers increased with increasing birth weight and length and was larger for females than for males of the same weight or length. No relation could be demonstrated between economic status or milk intake during pregnancy and the body dimensions of the infant or the size of these epiphyseal centers. 9 charts.—*Author's abstract.*

Does Glutamic Acid Administration Influence Mental Function? *Harold G. Loeb and Read D. Tuddenham, The Permanente Foundation, Oakland, Calif. and the University of California, Berkeley, Calif.* Pediatrics 6: 72–77, July 1950.

Thirty-three feebleminded subjects without epilepsy or other neurologic involvement were divided into two groups matched as to intelligence quotient, sex, age and type of feeblemindedness. They were

mostly adolescents. One group received orally 1 (+) mono-sodium glutamate, 24 Gm. daily, for 17 weeks. The other group, the controls, received a placebo given at the same time and in like manner. Throughout the investigation, both the experimental and control cases were patients in the same institution, on the same regimen and receiving the same care and diet. The following psychologic tests were administered before and after the experimental period: Stanford-Binet (Form L before and Form M after), Cornell-Coxe Performance Ability Scale, Porteus Maze, Thurstone and Thurstone Primary Mental Abilities and the Rorschach Test.

"On the basis of detailed statistical analysis employing the method of co-variance, no significant difference between control and experimental subjects could be shown, and it was therefore concluded that a beneficial effect of glutamic acid in the treatment of feeblemindedness has not been demonstrated." 11 references. 2 tables.

The Diagnosis and Treatment of Tuberculous Meningitis in Children. *Edith M. Lincoln, and Thomas W. Kirmse, Children's Medical Service, Bellevue Hospital, and the New York University–Bellevue Medical Center, New York, N. Y.* Am. J. M. Sc. 219: 382–93, April 1950.

In early tuberculous meningitis the early symptoms of tuberculous meningitis are those often seen in children with minor illnesses: fever, vomiting, drowsiness or apathy. Irritability and headache are common at the onset. In 167 patients a generalized convulsion initiated the illness in about 20% under 2 years of age, but was uncommon after this age and was not noted in children over 5 years old. In most cases the onset was gradual, the neurologic examination remaining normal during the first stage of general symptoms. The onset of stupor was accompanied by a variety of transient and shifting neurologic signs. The final stage of the disease was usually one of steadily increasing stupor with periods of return to consciousness in rare instances. The duration from the first symptoms to death varied from 1 to 63 days.

Of 92 children with primary tuberculosis in whom tuberculous meningitis developed while under observation, 77% died of meningitis less than a year after the first diagnosis of tuberculosis. Over 42% of the cases of meningitis occurred within 3 months after primary tuberculosis was discovered. In any child with manifest primary tuberculosis the physician should look with suspicion on symptoms whose cause is not obvious or which do not yield to appropriate therapy. "A convulsion in a tuberculous child, especially in an infant, should always be an indication for an immediate lumbar puncture." Fever, drowsiness, or vomiting should suggest the possibility of meningitis in any tuberculous child.

The object of chemotherapy is not only to save life but also to prevent irreversible cerebral changes. The chances of hydrocephalus developing seem to increase with the duration of tuberculous meningitis.

A clear spinal fluid with cells ranging in number from 10 to 350 per cu. mm. was found in 86% of the cases. Rarely, especially in the fulminating case, the cells may be increased even over 1000 per cu. mm. Lymphocytes usually predominate. A high proportion of polymorphonuclear leukocytes tends to be associated with rapid progression. The fluid on standing usually develops a pellicle in which tubercle bacilli can frequently be demonstrated. Tubercle bacilli occasionally can not be demonstrated by culture or guinea pig inoculation. The protein content tends to be high and to rise as the disease progresses. The sugar content tends to be low even on the initial tap.

Tuberculous children may exhibit physical signs and symptoms very suggestive of meningitis and yet go on to complete recovery. This clinical picture is called serous tuberculous meningitis. It is probably due to a perifocal reaction about meningeal seedings or to inflammation around older caseous foci in the cortex or meninges. In the early stages it is impossible, on clinical examination alone, to distinguish caseous from serous tuberculous meningitis. The differential diagnosis can be made earlier and more easily by study of the spinal fluid. An increase in pressure and cells may be present in either form of meningitis but there are no changes in chemical constituents in serous meningitis; the sugar, protein and chloride content all remain within normal range. No pellicle develops. Tubercle bacilli are rarely found.

Streptomycin is the drug of choice. Despite some authors' good results with streptomycin given only by the intramuscular route, the number of cures with combined intramuscular and intrathecal therapy is greater than with intramuscular alone. At Bellevue Hospital 18 children with tuberculous meningitis have been treated since December 1946, with streptomycin combined with a sulfone, promizole. Promizole seems to have an inhibitory effect on hematogenous tuberculosis in children.

The authors give 1 Gm. of streptomycin daily to all children regardless of age or size; as a single dose to well nourished older children or 0.5 Gm. twice daily to infants or emaciated children. Intramuscular streptomycin is continued for 180 days. In addition 0.1 Gm. is given daily intrathecally until toxic symptoms or mechanical difficulties arise. If toxic symptoms recur, 0.05 Gm. to 0.1 Gm. is given every second or third day. The course consists of 40 intrathecal injections. The full course of both intramuscular and intrathecal streptomycin is repeated if the patient relapses.

Promizole is given orally at 6-hour intervals. The initial dosage is 0.5 to 1.0 Gm. daily. In the absence of toxic signs the dose is gradually increased until a blood level of 1.0 to 3.0 mg. per 100 cc. is obtained.

Absorption curves in children show that the peak is reached 2 to 4 hours after oral administration of promizole. Blood for determination of level should be taken during this period, usually at 3 hours after the drug has been given. Adequate blood levels have been maintained with dosages from 0.375 Gm. to 8 Gm. daily. It is planned to continue promizole for 3 years until the results of treatment can be assessed in at least 25 cases of meningitis. There is no apparent relation between the level obtained and the dosage or the weight of the child.

When promizole has been given in combination with streptomycin, relatively few toxic effects have been seen. Children receiving promizole show at times a cherry red or pink urine; the significance of this is not known. Most of the children have been slightly but inconstantly cyanotic. A goitrogenic effect of promizole has been evident in most cases after several months; the cholesterol content of the blood sometimes becomes elevated and the thyroid gland becomes palpable. Small amounts of desiccated thyroid apparently counteract the goitrogenic action of promizole. Vomiting is frequent, especially during the first weeks; in only 1 case was this so severe that therapy had to be temporarily discontinued. Four children had generalized papular or urticarial eruptions, in 2 cases associated with or followed by eosinophilia. In 1 the rash developed into exfoliative dermatitis. One had an elevated blood nonprotein nitrogen, associated with cylindruria, of brief duration. Four patients became deaf during the course of treatment but in only 2 has the deafness persisted after treatment with streptomycin was discontinued. Every patient gave some evidence of ataxia after 3 to 4 weeks of treatment. Clinically, every child who recovered made an apparently satisfactory adjustment; no child has had permanent ataxia. Retesting of 5 cases more than a year after streptomycin had been discontinued showed that 4 had regained normal response to caloric stimulation by the Kobrak test.

Dihydrostreptomycin has been used in 3 cases. Loss of response of the vestibular branch of the 8th nerve to caloric stimulation has occurred later than with streptomycin. In other forms of tuberculosis treated with dihydrostreptomycin the vestibular response returned within a few weeks after therapy was discontinued. Increased vertigo and ataxia, transient strabismus or nystagmus or projectile vomiting may develop within a few hours after an intrathecal injection of streptomycin. More serious reactions occur occasionally.

Of 18 patients with meningitis who have completed treatment with streptomycin and are continuing with oral promizole, 13 survive 9 to 27 months after the initial diagnosis. All are mentally normal. Four have neurologic damage, none seriously crippling. "The addition of adequate amounts of promizole to streptomycin would seem to be of advantage in the treatment of tuberculous meningitis." 21 references. 1 table.

Effects of Intrathecal Tuberculin and Streptomycin in Tuberculous Meningitis. *Homer V. Smith and R. L. Vollum, Radcliffe Infirmary, Oxford, and Military Hospital, Wheatly, England.* Lancet 2: 275–86, Aug. 1950.

This report describes the use of tuberculin intrathecally in the treatment of 3 patients with tuberculous meningitis in conjunction with intrathecal and intramuscular streptomycin therapy with very encouraging clinical results. A review is also made of 84 patients with tuberculous meningitis treated during the past 4 years with intramuscular and intrathecal streptomycin. The overall rate was between 40 and 50%. Earlier diagnosis and longer courses of streptomycin, particularly intrathecally, have made the mortality rate nearer 40% than 50% in the last 2 years. The dosages of streptomycin were 50 to 75 mg. daily, intrathecally; 20 mg. per pound of body weight of streptomycin was given intramuscularly and continued for at least 6 months.

During the first few weeks of streptomycin therapy of tuberculous meningitis, characteristic changes occurred in the cerebrospinal fluid. There were high day-to-day fluctuations of the cell count with peaks varying from 600 to 1600 cells per cu. mm., and fluctuations in the amount of spinal fluid protein, the peaks being 100 to 200% above previous levels. These changes are believed to be specific for tuberculous meningitis under treatment with streptomycin. These changes were not due to secondary infection, for repeated cultures for pyogenic organisms were sterile. The changes apparently were not due to nerve irritation from the intrathecal streptomycin, for (1) they tend to disappear despite prolonged intrathecal use of the drug, (2) they cannot be reproduced by another course of streptomycin after the active infection is controlled, (3) they have not been observed in cases of mistaken diagnosis of tuberculous meningitis in patients treated unnecessarily with streptomycin, and (4) they are not seen in H. Influenzae meningitis treated in this manner. It was postulated these changes result from accumulation of the breakdown products of tubercle bacilli, i.e., of tuberculin, in the spinal fluid of sensitized patients.

To check this hypothesis further tests were done. Patients without meningitis, but sensitive to the tuberculo-protein as shown by a sensitive Mantoux test, were given small amounts of tuberculin (P.P.D.) intrathecally, using 0.00375–3.75 μg. The smaller dosage resulted in fever and vomiting, and also a pleocytosis and a rise in the protein of the spinal fluid indistinguishable from the changes seen in untreated tuberculous meningitis. Larger doses reproduced the changes seen in the spinal fluid when tuberculous meningitis is treated with streptomycin. All of these changes reverted to normal after several days. In patients in whom the Mantoux test is negative there was no clinical response and the spinal fluid disturbance was negligible.

The intrathecal administration of tuberculin (P.P.D.) was then tried in 3 patients with tuberculous meningitis who had grown progressively worse in spite of intensive streptomycin treatment, and in whom the spinal fluid and cell fluctuation had disappeared. In these 3 cases the intrathecal injections of tuberculin, given when the patients were apparently moribund, reproduced the rise in cells and protein seen typically during the first few weeks of streptomycin therapy. In 2 of these patients the injections were followed by a totally unexpected gradual recovery which appears to be complete over a year after treatment was first begun. A third case, in whom decerebrate rigidity was present, was chosen as this is the one condition in which no improvement of any kind has ever been seen with streptomycin. The course of the illness was prolonged for six months and a definite objective improvement was observed although the patient finally succumbed. At autopsy no exudate was seen macroscopically surrounding the brain stem—a finding unique in the experience of these authors in cases where decerebrate rigidity was demonstrated. In all 3 cases severe exudate must have been present, and was resolved after tuberculin was given. Streptomycin should be given concurrently with tuberculin to avoid possible local or general dissemination of the infection.

The following plan of treatment with tuberculin was employed. A "standard" solution of P.P.D. is made up containing 7.5 μg. per ml. and this is further diluted 10-fold, 100-fold, and 1000-fold. If the intradermal Mantoux to O.T. 1/1000 is strongly positive, then 0.5 ml. of the 1000-fold dilution is injected intrathecally and this amount is doubled every other day until a reaction is obtained. If the Mantoux is weakly positive to O.T. 1/1000, then 1.0 ml. of the 1000-fold dilution is injected and this dose is trebled or quadrupled every other day until a reaction occurs. Once a reaction is obtained, as shown either clinically or by a rise of the cells and protein in the spinal fluid, the same dose is repeated. Thereafter the size and timing of each injection depend upon the severity of the last reaction. In general, injections every 4 days are employed, allowing 2 to 3 days free from fever and vomiting. The length of time the injection must be given is not known. The authors continue them until the patients have become convalescent, free from any signs or symptoms of active meningitis. The reactions may be quite severe, consisting of an acute exacerbation of meningeal signs and symptoms. Coma, increased intracranial pressure requiring ventricular taps, hyperpyrexia and tonic extensor rigidity may occur. These episodes are usually short, the patient improving within 24 hours. Intrathecal injections of P.P.D. may be extremely dangerous in the presence of active meningitis; they require close observation of the patient and daily analysis of the spinal fluid. It is suggested that frontal burr holes be made before institution of therapy so that ventricular taps may be done if necessary.—*W. C. Blair.*

Otitis Media Acuta in Children 0–3 Years of Age. *I. P. Valdemar Poulsen, Copenhagen, Denmark.* Acta oto-laryng. 38: 120–29, April 1950.

Of 423 children, aged 0 to 3 years, treated in the Ear Department of the Rigshospital, Copenhagen, from 1928 to 1940, 210 having a total of 306 attacks of otitis media were re-examined with special reference to the acoustic function. The examinations included examination of the ears and the upper air passages, hearing tests for whisper and speaking voice, audiometry and roentgen examination of the mastoid process. One hundred and forty-five patients with 232 attacks of otitis media had received conservative treatment, whereas 65 patients with 74 attacks of otitis media had been submitted to simple mastoidectomy.

Among 141 cases with non-recurrent otitis media, normal audition was found in 73%. The audiograms of 23% presented hearing losses for the high tones, of 11% for the low and medium tones. The hearing loss was found to aggravate proportionally with the duration of the otitis, patients with hearing losses for the lower tone generally being found among the protracted cases.

In the 91 cases with recurrent otitis, there seemed to be no correlation between the duration of primary otitis or the age at which primary otitis was incurred and the predisposition to recurrence. On the other hand, affections in the rhinopharynx seemed to play a role in that the predisposition to infections in the upper air passages in the group of recurrent cases was more pronounced than in the remaining patients. The recurrences generally occurred soon after the primary otitis. The majority of them were observed within the first year. Ninety three per cent of all the patients had their first recurrence within the first three years. Acoustic examination of these patients disclosed 41% with normal hearing, 9% with losses for the high tones, while 50% presented losses for the low or all the tones in the audiograms.

Among 74 patients with otitis media who were submitted to simple mastoidectomy there were 42% recurrences; 57% of these had normal audition, 12% had losses for the high tones, and 31% for the lower or all tones.

Comparison between the conservatively treated patients and the patients submitted to operation seems to show that the mastoidectomy and the special conditions which necessitate that operation have no importance either for the disposition to recurrence or for the restitution of hearing.

Investigation of the duration of otitis as compared to the moment of operation revealed that the restituion of hearing was better the earlier in the course of the affection the mastoidectomy was performed. 14 references. 5 tables.—*Autor's abstract.*

OBSTETRICS

Anoxia as a Cause of Fetal Death and Congenital Defect in the Mouse. *Theodore H. Ingalls, Francis J. Curley and Richard A. Prindle, Boston, Mass.* Am. J. Dis. Child. 30: 34–45, July 1950.

The hypothesis that anoxia at critical stages of intrauterine development is an important cause of fetal anomalies was tested in albino mice. Sixty-five pregnant females were exposed to simulated altitudes of 27,000 feet in a decompression chamber for 5 hours at room temperatures on various days of pregnancy. Another 68 females were similarly exposed at 25,000 feet. The onset of pregnancy was dated from the appearance of the copulation plug. Fetuses were delivered by surgical section on the eighteenth day of gestation in order to obtain accurate counts of defective and resorbed products of conception. A third group of 60 mice served as controls.

A significant diminution of litter size was noted in the mice subjected to anoxic insult as compared to the controls. This was most marked on the eighth, ninth and tenth days when only 12 animals were born as compared with an expected 83. In addition, three anencephalic monsters were observed among the litters of three mothers subjected to a simulated altitude of 25,000 feet on the eighth day of pregnancy. Nine mice with cleft palate from three separate litters followed anoxia at 27,000 feet on the fourteenth day of gestation. No abnormal controls appeared.

The conclusions drawn were that maternal anoxia during pregnancy may result in fetal death or anomaly and that the effect varies with the stage of gestation and the degree of anoxic insult. Anencephaly and cleft palate are regarded as stage specific defects in mammals like cyclopia in the fish. The hypothesis is advanced that rapidly differentiating tissues are more susceptible to anoxic insult than previously differentiated or "resting" cells. 10 references. 10 figures. 1 table. —*Author's abstract.*

UROLOGY

Effects of Terramycin on the Bacterial Flora of the Bowel in Man. *J. Di Caprio and L. A. Rantz, San Francisco, Calif.* Arch. Int. Med. 86: 649–57, Nov. 1950.

A study was made of the effects of terramycin on the bacterial flora of the bowel in man, particularly in the presence of ulcerative lesions of that organ.

A quantitative, as well as qualitative, determination of the aerobic microorganisms present before and after administration of the drug was carried out. In addition, all organisms identified were tested as to their sensitivity to penicillin, dihydrostreptomycin, and terramycin.

A total of 7 patients was included in this study. The dosage commonly employed was 750 mgs. of terramycin hydrochloride given orally four times a day. Two of the patients received 500 mgs. of amphoteric terramycin, a less soluble form than the salt, terramycin hydrochloride, and presumably less well absorbed, orally every six hours. The results obtained with the above dosage schedules were comparable. The duration of therapy varied from 2 to 22 days.

Analysis of the bacteriological examination of the stools before administration of terramycin revealed that the organisms most commonly present were members of the coliform group, nonhemolytic streptococci, and *Streptococcus faecalis*. The number of organisms present was quite variable depending in some measure on the underlying disease process.

In 5 of the 7 patients, within 48 hours of terramycin administration, all bacteria present before therapy were either entirely eliminated or markedly reduced. Subsequently, the normal flora was supplanted by yeasts and *Staphylococcus pyogenes*, var. aureus, coagulase negative, which were terramycin resistant.

Terramycin appeared to be superior to other antimicrobial agents commonly used to prepare patients for bowel surgery. 8 references. 2 tables.—*Author's abstract.*

Intestinal and Gastric Perfusion in a Patient with Severe Chronic Uremia. *N. S. R. Maluf, Columbia-Presbyterian Hospital, New York, N. Y.* J. Urology 64: 268–74, Aug. 1950.

The gastro-intestinal tract of a patient in severe chronic uremia has been perfused with 31.5 liters of 2 to 2.27 per cent anhydrous Na_2SO_4 in 23.5 hours. Inevitable leakage through the anus was through a rubber tube (1.6 cm., O.D.; 1.1 cm. I.D.) inserted into the rectum and attached to the buttocks with adhesive tape. Gastric suction through a separate tube introduced through the other nostril completely prevented vomiting which had occasionally occurred from influx of irrigating fluid into the stomach from the jejunum. The urea-clearance of gastric irrigation was 2.66 cc./min.; that by intestinal irrigation was 19.1 cc./min. The plasma-urea level was markedly reduced and 43 Gm. of urea were extracted by the procedure. The concentration of calcium in the gastric and intestinal perfusates was approximately equal. The total loss of calcium was 662 mg. This was replaced by calcium gluconate in the intravenous fluids (1 Gm. calcium gluconate = 89 mg. calcium). *The total loss of potassium was 2.34 Gm.* The intestinal route was considerably more efficient in removing potassium than the gastric. The plasma-Cl (as NaCl) fell from 574.6 to 523.9 mg./100 cc. during the procedure. The patient lost about 3 liters of extracellular fluid and was subjectively improved. 14 references. 2 figures. 2 tables.—*Author's abstract.*

OTORHINOLARYNGOLOGY

Prevention of Deafness. *Edmund Prince Fowler, New York, N. Y.* Arch. Otolaryng. 51: 42–48, Jan. 1950.

At all levels of hearing loss, prevention is of primary importance. The sure way is to institute preventive measures before any signs of deafness appear. This is the challenge, and the author believes we are slowly but surely progressing to a point where this can be done. Stress is placed upon the preliminary approach to the problem. From the etiologic standpoint the fundamental and activating factors underlying the different types of deafness may be grouped as follows:

These factors may interact and overlap singly and in combinations, and be affected by certain participating conditions such as pain, tinnitus, vertigo, emotional reactions, personality and environment. The different factors are discussed in detail, particularly rubella, scarlet fever, pertussis, mumps, measles, encephalitis and meningitis, and the means for preventing and controlling them and the deafness they frequently engender. The author then considers the great unknown in otology—otosclerosis—and discussed possible means for its prevention. The use of surgical treatment to overcome or circumvent some of the hearing loss is widely exploited but statements to the contrary notwithstanding, so far as is known these operations in no measure cure the disease, or prevent its progress. They have no effect whatsoever on the sclerotic bone of the lesion, or on the ankylosis of the stapes which is the cause of the deafness from otosclerosis. Much is known about the appearance of the bone in otosclerosis. It has been examined under high power magnification and by polarized and ultraviolet light from its tiniest beginnings to its longest development; its morphology has been described but it has not revealed the cause of the lesion. Considerable is known about its inheritance.

Fundamental	Activating	Type of Deafness
Hereditary	Anomalies of development	Impedance External ear Middle ear
	Benign and malignant growths	Capsule (otosclerosis) Inner ear
Congenital	Traumas: rubella, poisons and drugs; diet; metabolic, endocrine; autonomic, psychosomatic and vascular disorders (anoxia)	Neural Peripheral Medullary Central (cortical)
Acquired	Infections (bacterial virus)	
Unknown	Allergies	Psychogenic Malingering

Clinically, certain observations and laboratory findings seem to be correlated to the activation of the lesions and the increases in deafness. Among these, emotional and endocrine disturbances and severe illnesses are outstanding. Experimentally, a multitude of bone dyscrasias may be caused by hormonal imbalance and food deficiencies, but all efforts to produce typical otosclerosis in animals by these or any other means have failed. There must be a basic biologic reason for such failures; they are, the author believes, due in part to the more rugged or stable emotional status of the lower animals, their lower level of cerebration and their less prolonged emotional reactions. Also, these failures are primarily due to the absence of the inheritance factors in animals; their ancestors never having had otosclerosis, they cannot have inherited any predisposition to it. This holds also for human beings who have not inherited a definite predisposition to it. They too may be subjected to the identical factors which in others are associated with activating factors, and yet they do not acquire otosclerosis. Until we are able to produce it in animals, the author states he will hold to the opinion that otosclerosis cannot be produced in human beings unless there is an inheritance favorable to it. It is his continuing task to find means for determining the activating factors involved.

The author believes that every child in otosclerotic families should receive thorough and complete medical examinations and laboratory checkups. Signs and symptoms which in other types of deafness may be of little or no import appear significant when preclinical or early diagnosis of otosclerosis is the object. Certain of these signs are then given in detail. No one is sufficient for a preclinical or postclinical diagnosis, but when several are present they become important, especially so in otosclerotic families. The author observed that blue sclera were present in two-thirds of his otosclerosis cases whereas in the controls only about 10% showed blue scleras. This does not mean that the otosclerosis or its severity was necessarily closely related to the blueness of the sclera but it does indicate that there may be some relationship between the two conditions.

The mere attempt to prevent otosclerosis or its progress may produce, and in a few instances has produced, by trial and error a greater knowledge of some of the factors seemingly correlated to the lesion and, also of importance, many of the factors seemingly having no relation to it. Such knowledge is valuable. By continuing experimentation and close observation, we have obtained several aids to diagnosis and treatment, and though they are far from being one hundred per cent reliable, the author ventures to state that in many instances they would be invaluable if we had a greater opportunity to examine patients before or even soon after deafness is detectable. The only practical way to accomplish this is to test every child routinely during all the school years, and to test adults at every opportunity, acting accordingly and promptly.—*Author's abstract.*

OPHTHALMOLOGY

Rutin and Dicumarol in Ophthalmology. *Paul Weinstein and Joseph Forgács, Hospital of the Israelitic Community, Budapest, Hungary.* Ophthalmologica 119: 122–25, Feb. 1950.

In 18 cases of retinal hemorrhage (including 1 case of Eales' disease and 7 cases of diabetic retinitis) treatment with vitamin P, in the form of rutin, rutinol or vitaplex P, is reported. Treatment was continued for periods varying from two weeks to three months, using a daily dosage of 60 mg. No further hemorrhages occurred during treatment; the former hemorrhages were gradually absorbed, with resulting improvement in visual acuity. In the cases in which capillary fragility was determined, it was found to be definitely decreased by the treatment. In cases in which there was thrombosis of a central retinal vein, dicumarol was used in combination with the vitamin P treatment. Dosage was controlled by frequent determinations of the prothrombin time. Daily doses of 100 mg. were given if the prothrombin time did not decrease below 30%. After an interval of one or two days, treatment was continued for two or three weeks, to keep the prothrombin time between 20 and 30%. In cases of thrombosis of the central retinal vein improvement was more rapid with the combination of rutin and dicumarol than with rutin alone. 14 references. 1 table.

The Use of Hyaluronidase in Some Corneal Affections. *H. M. Dekking, University of Groningen, Holland.* Ophthalmologica 119: 63–64, Jan. 1950.

In some cases of filamentary keratitis, there is blockage of the lacrimal glands, but in other case lacrimation is normal, so that it appears that the keratitis is not due to absence of lacrimation, but to the absence of some substance in the lacrimal fluid, which may be lysozyme. As pure lysozyme is hard to obtain, the author has employed a preparation of hyaluronidase available in Holland ("hyason"). A solution of 5 units per cc. was instilled into the affected eye four to five times daily. It has been found that if this treatment is effective, the keratitis clears up promptly. If there is no definite improvement in one or two days, it is useless to continue treatment. In some cases a definite cure was obtained, with no recurrence. In some cases there was a recurrence, but this also responded promptly to the hyaluronidase therapy. The author mentions 6 cases of filamentary keratitis of long standing that had not responded to other methods of treatment, but cleared up promptly when the hyaluronidase drops were used; on the other hand, 1 similar case in a boy 12 years of age did not respond. The treatment has also given good results in some cases of superficial punctate keratitis.

Hole in the Macula (*Trou dans la macula*). *J. Brahy.* Union méd. du Canada 79: 146–47, Feb. 1950.

The morning after spending a day at the beach an adult male noticed a black spot before his right eye. No lesion could be seen at the macula. However, four months later a round white hole was visible. Fourteen months later the hole was still present. Vision of the eye was markedly reduced and a central scotoma was present. 3 references.—*Clement McCulloch.*

Effect of Certain Vasomotor Drugs on the Vessels of the Fundus Oculi (*Accion de algunas drogas vasomotoras sobre los vasos del fondo de ojo*). *Hector Serani, Ricardo Guzman and Rufina Echeverria.* Rev. méd. de Chile 78: 117–20, Feb. 1950.

A careful study is presented of the state of the retinal vessels in various patients following the administration of histamine diphosphate, 1% trinitrin solution and sodium nicotinate. In general all 3 drugs cause cutaneous and retinal vasodilatation. With trinitrin, there is less cutaneous vasodilatation but more frequent retinal hyperemia which may be slight or transitory, but is practically constant. Sodium nicotinate produces maximal cutaneous vasodilatation, and in more than half the cases a definite retinal hyperemia. It is concluded that the pial, retinal and facial vessels respond as a unit, but not always to the same degree.

Relative Growth of the Eye. *F. W. Weymouth and M. J. Hirsch, Department of Physiology, Stanford University, San Francisco, Calif.* Am. J. Optom. & Arch. Am. Acad. Optom. 27: 317–28, July 1950.

An analysis by the method of relative growth was made of the diameters of the eye using the anatomical and x-ray values of several authors. Because of its lesser variability and higher correlations the vertical diameter was used as the basis of comparison. The plot of the log transverse on the log vertical diameter gives a single straight line with a slope not significantly different from unity, showing that throughout life these two diameters grow at the same rate and the shape of the equatorial cross section does not change. The plot of the log axial on the log vertical diameter, however, consists of three sections. The first, or fetal segment, ends at birth with a vertical diameter of 15 or 16 mm., the second ends at about 20 mm. and the third includes all larger sizes; none of the sections, except the first, can be defined by definite ages. During the first section the shape of the globe does not change. In the second, the slope is significantly less than unity, indicating that the axial length is growing less rapidly than the equatorial diameters, thus giving a relatively short globe. In the third section the slope is slightly greater than unity, giving, in the larger eyes, a globe that is

relatively long. The refractive state of the corresponding periods of life agrees with these findings. During the first 1 to 5 years of life there is an increase in the numbers of hyperopes and from about 6 years to the completion of growth there is an increase in the numbers of myopes and, in many individuals, an increase in the degree of myopia. 11 references. 5 figures. 3 tables.—*Author's abstract.*

BOOK REVIEWS

Child Psychiatry in the Community: A Primer for Teachers, Nurses, and Others Who Care for Children. *Harold A. Greenberg, Julian Pathman, Helen Sutton and Marjorie Browne, New York, N. Y.* G. P. Putnam's Sons, 1950. $3.50.

This most excellent introduction to the theory and practice of child guidance should be required reading for all who are going into pediatrics. The book begins with discussion and illustrations of the normal development of personality and the genesis of behavior disturbances in children. Treatment in a child guidance clinic is described so that the reader is aware of the related movement of parent and child receiving help. Parents are sympathetically treated, being presented as individuals who not only exert influence upon the child but are also being acted upon by the child. While acknowledging the differences in attitude which exist among the various clinics, the authors emphasize that all stress the collaborative process of therapy which includes psychiatrist, psychologist, nurse, and social worker.—*J. Rudolph.*

Hemolysis and Related Phenomena. *Eric Ponder, The Nassau Hospital, Mineola, N. Y.* New York, Grune & Stratton.

The erythrocyte, lacking a nucleus, is morphologically one of the simplest cells of the human body, yet as it participates in the vital functions of respiration and circulation it can be abnormally affected in a wide variety of ways. A complex mass of data and speculation exist with respect to the nature of hemoglobin and stroma and their cytoarchitectural and dynamic relations.

In this monograph the attempt has been successfully made to outline and synthesize current knowledge concerning the mechanisms of red cell structure and disintegration. Practical implications are intimately mingled with basic theoretic considerations. No physician interested in hematology can claim to have a fundamental insight into the nature of the anemias without having carefully studied this monograph.

Adoption Laws in Latin America by Anna Kalet Smith. Washington, D. C., Federal Security Agency, Social Security Administration, Children's Bureau Publication No. 335, 1950.

This bulletin contains a brief history of adoption laws in fifteen Latin American countries, an analysis of present legislation, and summarized translations of the laws of each country where these are known to exist. The sources are original law publications from the various countries.

Methodology and Techniques for the Study of Animal Societies. *J. P. Scott, John B. Calhoun, C. R. Carpenter, N. E. Collias, John T. Emlen, J. L. Fuller, Leonard J. Goss, Laurence Irving, Bernard F. Riess, T. C. Schneirla and John W. Scott, New York.* Ann. New York Acad. Sc., Vol. 51, No. 6. $2.50.

This monograph serves as a general introduction and handbook for the study of "sociobiology" and animal behavior under field conditions. The papers explore the relationship of concepts and methods to the study of animal behavior and the comparative method in sociobiology, discussing various aspects of heredity and environment. Other papers deal with such subjects as metabolic reactions to cold and the effects of nutrition and disease.

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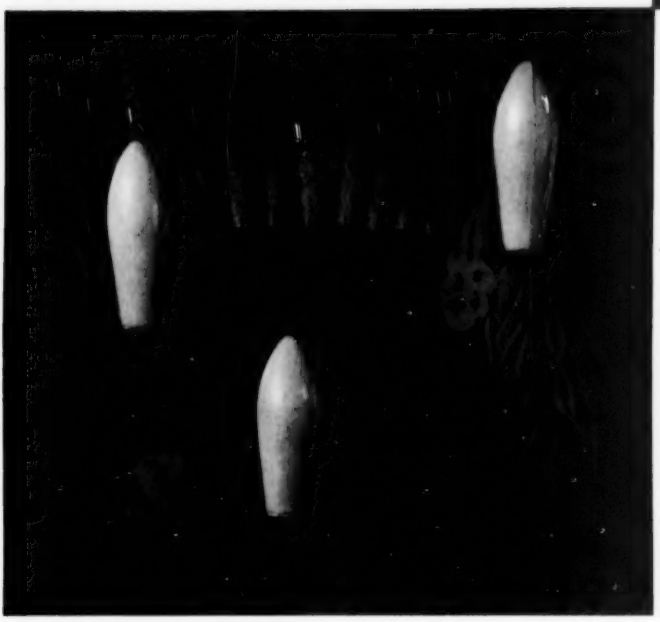

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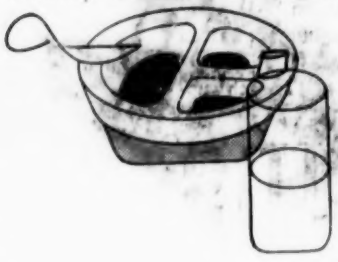

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